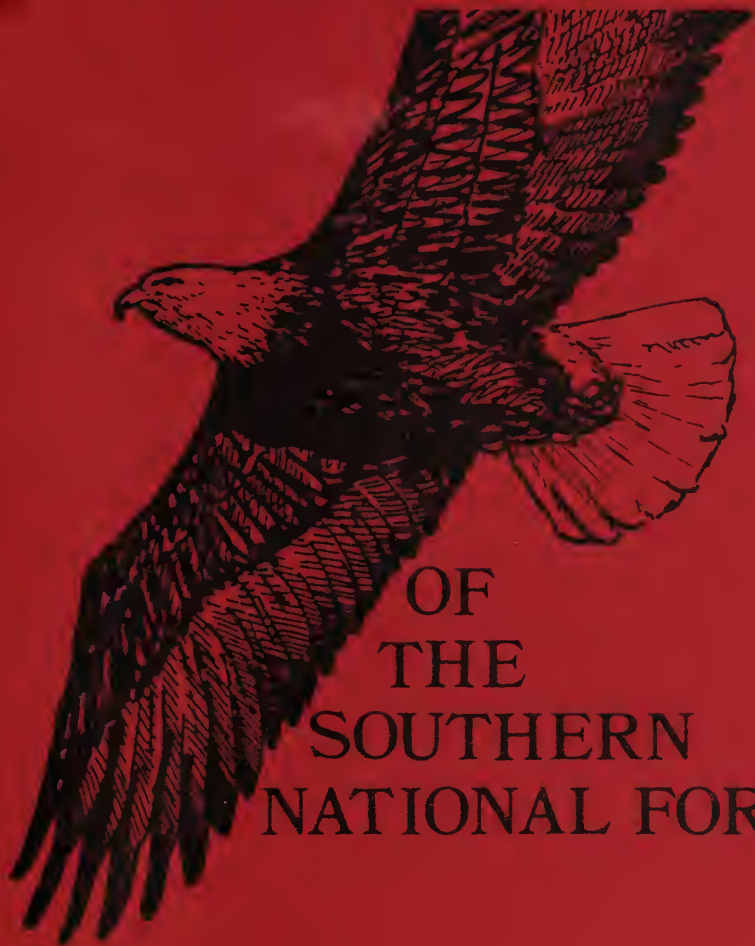


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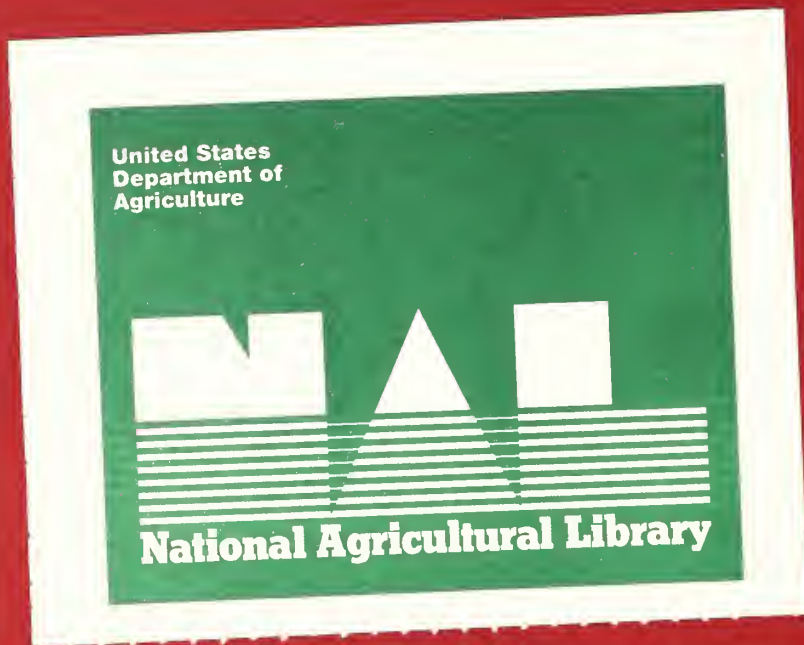
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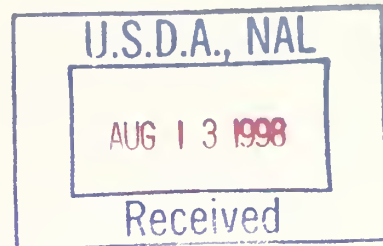
OF THE SOUTHERN NATIONAL FORESTS

- Distribution • Populations • Habitat Requirements •
- and their Influence on the National Forests •



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Foreword



In 1972 the Southern Region of the Forest Service, USDA entered into a contract with the author to conduct a survey of rare, endangered and unique birds of the Southern National Forests. The author was to provide information on the distribution and occurrence, population estimates, life history, habitat requirements and management recommendations. This information to be assembled from a thorough review of literature, museum collections, published and unpublished reports by competent observers and contacts with experts in the field. We relied heavily on the knowledge and experience of the author. We believe he succeeded admirably in providing us with the needed information to help guide habitat management of these species on the National Forests.

The Endangered Species Act of 1973 changed the terminology from rare and endangered to endangered and threatened while the work was underway. We have continued the use of the old terminology since this is the context in which the survey was made and written. The species discussed include all those presently on the endangered list plus others that are threatened or unique.

Special acknowledgement and recognition is given to W. David Chamberlain, Special Assistant, The Charleston Museum, Charleston, South Carolina for his dedicated effort on the project. Herman L. Holbrook, Wildlife Biologist in the Regional Office of the Southern Region coordinated the effort with the National Forests.

Atlanta, Georgia
November 6, 1974

U.S.D.A. W.F.

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WOOD IBIS
Mycteria americana (Linnaeus)

I. General Distribution and Status

The wood ibis, or wood stork, occurs in the southeastern United States and in Central and South America south to Patagonia. In the United States its range includes the coastal States from South Carolina to Texas, but post-breeding season migrations sometimes carry it up the Mississippi Valley to southern Illinois and southeastern Indiana, up the Atlantic Coast at least to North Carolina, and in the West, to southern California.

The species was considered fairly common in suitable habitat during the 1800's and early 1900's. It is now much reduced in numbers, though the size of the total population is uncertain. The Cuthbert Island colony in Everglades National Park had about 75 pair still nesting as late as May 1971, but only produced about 25 young. In 1965 this population was estimated at 5,200 birds but was down to about 2,500 in 1971. The Corkscrew Swamp (approximately 2,000 pairs) produced about 2,000 fledglings in 1970-71. In the same season, 150 to 200 birds were fledged at Pelican Island Refuge. From 15 to 125 young were fledged at six other colonies in central Florida. Overall estimates are in the range of 6,000 to 9,000 nesting pairs, with only about 1,000 young produced in 1972.

The 1973 Edition of Threatened Wildlife of the United States, USDI, lists the wood ibis in the "status-undetermined" category, which means that there is insufficient information to determine whether the species should be included in the "threatened with extinction" category.

II. Life History and Habitat Requirements

1. General

The wood ibis is primarily a bird of coastal and near-coastal areas, and is usually found in swamps and marshes. It uses both fresh and salt water areas, generally occurring in small flocks. It is striking in appearance, standing 3 1/2 to 4 feet tall, white except for the black wing-tips and tail, with head and legs unfeathered. The heavy bill is slightly downcurved. On the ground or standing in a tree the wood ibis seems a rather awkward bird, but in flight it shows both grace and power. When flying, the head, neck, and legs are fully extended. It will circle and soar to great heights, and occasionally engage in aerial acrobatics.

The wood ibis is usually a shy and wary bird. It is slow to mature, probably taking four years to become fully adult. Immature birds have feathered heads, and the wing plumage is tipped with dull brown while the body plumage is dull white.

2. Food

Wood ibis feed primarily upon small fish, frogs, tadpoles, small snakes, crabs, and insect larvae. Very occasionally a few fruit of gum or buttonbush may be taken. Most of the feeding is apparently done by touch, for groups of birds generally feed together in shallow water, moving about and making the water very muddy. As they walk about, they drag their bills through the water, opening and closing them repeatedly. This muddying of the water seems to stir up fish and other aquatic animals, bringing many of them to the surface. Studies of food consumption in the wood ibis indicate that a colony of 6,000 birds requires more than 2.5 million pounds of fish in one nesting season. Most of these come from within 20 miles of the nest sites.

3. Nesting

Wood ibis in past years apparently nested either high in the tops of big cypress trees, or low (6 to 40 feet above ground) in mangroves. Nests in cypress trees are usually placed far out on horizontal limbs and may be 50 to 100 feet above the ground, or water in which the trees stand. Each tree may hold from 2 or 3 to 10 or 12 nests which are loosely built of large dead sticks lined with finer twigs, leaves, or Spanish moss. These nests are 2 to 3 feet in diameter.

The former nesting range of the wood ibis in the United States extended from Florida up the Atlantic Coast to South Carolina (though nesting records for that state are circumstantial), and around the Gulf Coast to Texas. In Florida the species was considered to be abundant, and as late as the 1930's nested in numerous locations in south and central Florida and in a few locations in north Florida. Today, nesting is apparently limited to the Big Cypress Swamp and Everglades National Park in southwest Florida and a few small areas in the north-east and mid-east parts of the State. Nesting season is usually January and February, but may begin in December and extend to late March.

Three eggs are usually laid, sometimes four or five. The shell is smooth, dull white to creamy white in color. Incubation is by both male and female and require 28 to 32 days. The young are not usually brooded after the

first week unless the weather is unusually cold or wet. One of the parent birds, however, is almost always at the nest for the first five weeks after the eggs hatch to guard the nest against non-nesting wood ibis (probably immatures) that move about in the rookery and sometimes destroy eggs and young. The young birds remain in the nest for 50 to 55 days.

4. Limiting Factors

In 1926, Bent (Life Histories of North American Marsh Birds) wrote that the wood ibis had few enemies, was not prized for plumage or food, was wary and well able to take care of itself, and "likely to survive for a long time in its native wilderness". This assessment has turned out to be quite accurate, the key words being "native wilderness". It is true that there is very little direct loss of wood ibis, but the extensive changes which have occurred in wetland habitats have caused great reduction in populations and abandonment of practically all nesting areas except for Everglades Park, Big Cypress Swamp, and a few small locations in the northeast and midwest sections of Florida.

Because the wood ibis is gregarious and forms large nesting colonies, it requires large amounts of readily available food. These conditions are exceptionally well met in south Florida where the long growing season and seasonal rainfall combine to produce an abundance of aquatic life which becomes increasingly concentrated as the surface waters slowly dry up in late winter and spring. The wood ibis' needs are so closely related to this set of conditions that in very dry years it may not nest at all, while in ideal years it will have excellent nesting success. Thus, not only drainage and land clearing but also stabilization of water levels can damage wood ibis habitat. It is probable that combinations of these factors have been of greatest importance in limiting the populations of this species.

5. Management

Since it appears that unsuitable habitat conditions have been of most importance in limiting wood ibis populations, the primary concern of management must be to provide satisfactory habitat. Further, it appears that nesting habitat with ample food supplies and acceptable nest trees is the most critical deficiency. Such food supplies can be provided in some locations through appropriate water level management in large shallow impoundments. To be effective, these must be located close to stands of suitable nest trees. It is also probable that such management units would have to be within areas presently utilized to some

extent by wood ibis. New rookeries might possibly be established in suitable habitat by transplanting immature birds, but this technique has not been proved.

Aside from such intensive, specialized management, the wood ibis should be fully protected. Its required swamp and marsh habitat should be preserved from drainage, clearing, altering of water regimes, and contamination by pesticides.

III. Relationship to National Forests

Most of the recent records and observations of wood ibis in North Carolina are during summer and fall in the southeast portion of the State, especially along the coast. It does occur at times inland to the upper coastal plain and central sandhills. In Tennessee it is seen in the western part of the State but is considered uncommon.

It occurs year round in South Carolina, mainly in the Low Country, commonly in the summer and rarely in the winter. In Georgia too it is a fairly common summer visitor. Okefenokee Refuge reported 1,200 birds in April 1971 and St. Simons Island reported 400 in April 1972. It was reported as abundant on Cumberland Island and in Altamaha Swamp in June 1972. In Alabama it is an irregular summer visitor but did breed in Macon County in 1968.

Its status in Mississippi, Arkansas, and Oklahoma is quite similar, that of irregular and uncommon summer visitor. In Louisiana and east Texas the wood ibis occurs all year round but is usually seen only in moderate numbers.

Greatest numbers of wood ibis occur in Florida. Recent records include Duval, Nassau, Volusia, Brevard, Indian River, Lee, St. Lucie, Polk, Manatee, Collier, Monroe, Sarasota, DeSoto, Charlotte, Pinellas, Osceola, Okeechobee, Jackson, and Washington Counties.

Specific Christmas Count reports for recent years are:

<u>Location</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>
Key Largo	1	2		
Lakeland	110	1		77
Lake Wales	1	3	8	
Myakka Park		41		
Naples	1	31	11	
St. Petersburg		90	100	
Sanibel-Captiva	20	8	18	
Sarasota	25	3	26	
South Brevard	63	5	2	
Stuart	23		12	
Vero Beach	67		12	40
West Palm	37	2		
Bay County			34	
Merritt Island		205		
New Port Richey		18		
Bradenton	131	5	91	
Cocoa	64	79	58	
Coot Bay	1100		240	130
Ft. Myers	390	11	181	

Wood ibis are seen regularly and in fair numbers on the Francis Marion National Forest, and occur casually on the four Forests in Texas. The Ocala Forest is in a strategic location and easily could become more important to wood ibis than it is at present. The most recent estimate for Ocala was 100-200 birds. In addition to these six Forests, wood ibis might occur occasionally on any of the Gulf and Atlantic Coastal Plain Forests during summer and fall.

WHITE-FACED IBIS
Plegadis chihi (Vieillot)

I. General Distribution and Status

The white-faced ibis is primarily a species of western North America and southern South America, the two areas being discontinuous. In past years it was known to breed in California, Colorado, Idaho, Kansas, Louisiana, Nevada, Oregon, Texas, and Utah. Old records of one or two nests also exist for Wyoming, Nebraska, and Florida.

In 1965 there was one nesting location (10 pair) in California, and limited nesting (10 to 20 pair) in Colorado, Idaho, Kansas, and Oregon. Most nesting took place in Louisiana, Nevada, Texas, and Utah. The estimated United States breeding population in 1965 was about 10,000 pairs. The species also is known to breed in Mexico, but population estimates are not available.

The taxonomy of the white-faced is rather uncertain. Bent (1926) calls it Plegadis guarauna (Linnaeus). The 1957 A.O.U. Check-List considers it a full species, Plegadis chihi (Vieillot), while Palmer (1962) treats it as a subspecies of the glossy ibis, Plegadis falcinellus (Linnaeus). White-faced and glossy ibis have interbred in captivity, but because of the artificial conditions involved this is not considered proof of conspecificity. In at least one case the two forms occurred together in the same nesting colony in the wild. Imhof (1962) and others have pointed out that it is impossible to distinguish the white-faced from the glossy ibis except in adult breeding plumage.

The white-faced ibis is included in the "status undetermined" category of the 1973 Edition of Threatened Wildlife of the United States, USDI. This means that it should possibly be treated as threatened with extinction but sufficient information is not available to make this determination.

II. Life History and Habitat Requirements

1. General

The white-faced ibis is found primarily in marshes and coastal prairies with their associated ponds and sloughs where the typical predominant vegetation consists of cattail, bulrushes, various grasses, and some shrubs. The birds nest and roost in the deeper marsh vegetation, but will move considerable distances to feed in flooded fields, around sloughs and ponds, and in shallow marshes.

White-faced ibis are migratory. Most of those which nest in Utah, for example, migrate to central Mexico in September and October. Other important wintering ranges are the coastal areas of Texas and Louisiana. Thus, Texas and Louisiana have both breeding and wintering populations. In addition to regular migrations, white-faced ibis wander widely. Thus, it has been recorded from Hawaii, Alberta, North Dakota, Minnesota, Nebraska, and Missouri. The major part of such erratic movement seems to take place prior to the breeding season.

2. Food

The principal foods of the white-faced ibis are insects and insect larvae, earthworms, leeches, and snails. Much lesser amounts of spiders, crawfish, small fish, and seeds are taken.

3. Nesting

White-faced ibis usually nest in rather thick stands of bulrush and cattail in deep marshes. The nests are well built with deep cups, made of bulrush and cattail stalks, attached to and supported by broken and upright living stalks. Nests are usually situated about 4 feet above the water. Often the nesting colony also includes egrets and various herons.

Three or four eggs are the general rule, but sometimes there may be as many as seven. They vary in color from pale green to pale blue. Incubation requires 21 or 22 days, and probably is shared by the two parents. The young are fed and cared for by the adults for about 50 days.

4. Limiting Factors

Because the habitat of the white-faced ibis is largely confined to inland deep marshes and coastal prairies, it is probable that the extent and availability of these habitat types is the primary limiting factor on this species. The fact that they form very large nesting rookeries means that nesting localities must also provide tremendous quantities of food. Drainage and other habitat alterations are certain to have adverse effects upon populations.

The white-faced ibis is shot for food, sometimes commercially, in Mexico. It is also sometimes shot as a "game" species in various parts of the west and southwest, and at one time was a legal game species in

California. It is unlikely that this harvest caused any other than local reductions in population. Still, almost 83% of reported band recoveries resulted from shooting, so this factor cannot be dismissed. Other causes of death were botulism, predation, trapping, and "unknown".

Nesting success seems to be erratic from year to year. In dry years the birds may not nest at all while in wet years there is good success. Since it is likely that white-faced ibis do not nest until the second or even third year, each pair must fledge at least two young per year to maintain the population.

5. Management

Since the precise limiting factor on white ibis populations is not really known, it is difficult to prescribe any exact management program. The birds should be protected from shooting and nesting rookeries should be protected from disturbance and harassment. Habitat preservation is necessary if the species is to maintain itself. This means not only leaving the marshes and coastal prairies undrained and undeveloped, but keeping them in an unpolluted, healthy condition so that ample food supplies will be produced.

III. Relationship to National Forests

Although there are a few records of white-faced ibis occurrence in Oklahoma, Mississippi, and Alabama the species is largely confined to Louisiana and Texas so far as this region is concerned. In recent years it has nested in Plaquemines, Lafourche, Jefferson, and Cameron Parishes and on the Laccasine and Sabine National Wildlife Refuges. In Texas it has nested in Wellen and Matagorda Counties. Other Texas observations include Freeport, Old River, Bolivar Peninsula, Galveston, Baytown, Corpus Christi, and the Aransas and Santa Ana National Wildlife Refuges.

The white-faced ibis sometimes wanders inland and occurs as an irregular straggler on all four Texas National Forests, particularly the Angelina and Sabine. It could likewise occur on the Kisatchie in Louisiana but is less likely to do so than to appear on one of the Texas Forests. Even so, the white-faced ibis is such an infrequent visitor on any of the National Forests in the Southeast that any specific management program for it would be difficult to justify.

ROSEATE SPOONBILL
Ajaia ajaja (Linnaeus)

I. General Distribution and Status

The range of the Roseate Spoonbill includes South and Central America, the Caribbean Islands, and the Gulf and south Atlantic coasts of the United States. In South America it is resident and generally distributed on both coasts and along the larger rivers of the interior south to the central part of Argentina. Populations have been much reduced over the last 75 years and many former breeding areas are no longer used. In the United States it now breeds in south Florida, southwest Louisiana, and much of the Texas coast.

Birds may be seen throughout the year in all parts of the range, but the species is migratory. Individuals which nest in Texas and Louisiana generally migrate to Mexico while those which nest in Florida Bay most frequently move into other parts of south Florida, mainly Biscayne Bay to Tampa Bay. Some Cuban birds apparently move to and from Florida. In all populations, non-breeding birds may sometimes wander quite extensively.

The Roseate Spoonbill is listed as a "Peripheral Species" in the 1973 Edition of Threatened Wildlife of the United States, USDI. This means that its occurrence in the United States is at the edge of its natural range, and that it is threatened with extinction in the United States although not in its range as a whole.

In 1967, the whole Florida population was estimated at 2,200 birds and in 1968 the fall population of the Texas coast was estimated at about 4,500. In 1971 the peak population at Laccasine National Wildlife Refuge in Louisiana was about 400 birds. Approximately 60 young were fledged from 30 nests. In the same year, the peak population at Sabine National Wildlife Refuge, Louisiana, was about 525 birds. There seems to have been a general though slight increase in the United States populations during the past 10 years.

II. Life History and Habitat Requirements

1. General

Roseate spoonbills are rather gregarious, and usually are seen in small groups. They prefer coastal estuarine-type areas and usually do not occur very far

inland, although they commonly use fresh, brackish, and salt areas both tidal and non-tidal. Spoonbills roost and nest in bushes and trees and feed in shallow water ponds, sloughs, and flats. The distinctive pink plumage and spatulate bill make this a really spectacular bird.

2. Food

Spoonbills often feed at night, and may sometimes feed primarily from sunset to daylight. The birds wade about in the shallow water and mud, immersing their bills and even their heads while moving the mandibles from side to side to secure their food. The principal items are small fish, crustaceans, insects, slugs, and some mollusks. Occasionally a few seeds are taken.

3. Nesting

Nests in Florida are usually placed in red or black mangroves while in Louisiana and Texas willow, buttonbush, bulrush, and phragmites are used. Most frequently Spoonbills occupy rookeries in company with ibis and various herons.

When nests are in trees, they are usually 12 to 15 feet above the ground on horizontal limbs in shady situations. Such nests are built of sticks, lined with finer twigs and leaves. They are about 16 inches in diameter, with a cup about 7 inches in diameter and 2 inches deep.

There are usually 3 or 4 eggs, sometimes 2 or 5. These are dull or dirty white, rather evenly covered with spots and blotches of various browns. Incubation requires 23 to 24 days. Both male and female take part. The young leave the nest in 5 to 6 weeks but are fed by the parents until about the eighth week. The species is single-brooded.

4. Limiting Factors

During the late 1800's and early 1900's Roseate Spoonbills were in great demand for their plumage and wings which were made into feather fans. Tremendous numbers of birds were killed for this market, so many that the species very nearly became extinct in the United States. Fortunately, the plumage trade was stopped before this happened and as protection in general increased, Roseate Spoonbill populations increased in suitable habitat.

Such habitat has been reduced through dredge and fill

operations, mosquito control measures, industrial developments, pollution, and similar causes. Consequently, it is unlikely that population levels will ever reach those of a hundred years ago even though direct losses are now minimal.

5. Management

The two important factors that must be provided in any management program are protection and suitable habitat. The former is now generally good, public attitudes have improved, and commercialization has been almost entirely stopped. Preservation of habitat is another matter. Even though there is increased awareness of the values of coastal and estuarine areas, loss of this type habitat continues. Hopefully, this trend will be stopped by the implementation of better land use zoning and estuarine protection laws while there are still considerable acreages of this habitat left. If so, and if healthy conditions are maintained, adequate food supplies will be produced naturally. Otherwise, habitat management through manipulation of water levels in suitable areas can increase food production.

III. Relationship to National Forests

Aside from nesting records, observations of Roseate Spoonbill in Florida include Coot Bay in Everglades National Park, Upper and Lower Keys, Sanibel and Captiva Islands, Ft. Myers, south Brevard County, Myakka River State Park, Clewiston, Lake Okeechobee, Lakeland, St. Marks, Tarpon Springs, Merritt Island, and Amelia Island. In Louisiana, such records include Cameron Parish, Avery Island, Bayou Sara, and Catahoula Lake. A few scattered occurrences have been recorded in Alabama, Mississippi, Arkansas, Oklahoma, Tennessee, South Carolina, and Georgia. Texas observations include Brazos and Welder Refuges, Bolivar Peninsula, Corpus Christi, Galveston, Old River, Vingt'un Island, North Deer Island, Green Island, Sabine Lake, and Lake Livingston adjacent to Sam Houston National Forest.

From these records it is apparent that Roseate Spoonbills have only a casual relationship with any of the National Forests in the Southeast. The species may visit briefly on any of the Texas National Forests, and the Kisatchie, DeSoto, Homochitto, Bienville, Talladega, Conecuh, Apalachicola, Ocala, Osceola, and Francis Marion National Forests. If so, the birds should of course be protected. Because of the Spoonbill's affinity for coastal and estuarine habitats, however, it does not seem likely that specific management programs on National Forests in the Southeast would be worthwhile.

WHITE-TAILED KITE
Elanus leucurus majusculus (Bangs and Penard)

I. General Distribution and Status

The North American population of the White-tailed Kite has been given the scientific name cited here, while the South American population has been called Elanus leucurus leucurus although there is not complete agreement on this nomenclature.

North American White-tailed Kites are mainly western in distribution, but do occur across the southern states from California to South Carolina. The South American range includes northern Argentina and Chili to Venezuela and Surinam. Prior to the 1960's, it was considered to be absent, or rare and local, in western Mexico, southern Central America, and northern South America so that there was a wide area between the principal ranges of the two populations.

In the United States the White-tailed Kite has always been rare east of the Mississippi River. In the mid-1930's it was generally confined to California (Sacramento Valley to San Diego), and the coast of extreme south Texas. The California population apparently began to increase in the 1950's and during the 1960's there was an increase in population and extension in range. At the same time there was an extension of range through Central America and the Gulf Coast of Mexico. For a raptor, White-tailed Kites are fairly common in open and cultivated bottomland areas with scattered trees or on grassy foothill slopes in California.

There seems to have been a very slight increase in Texas, and a few birds have been seen in Florida, Georgia, and Alabama during recent years.

II. Life History and Habitat Requirements

1. General

White-tailed Kites prefer open and semi-open country and thus are often found in semi-arid situations, and in marshy areas especially if there are scattered trees. The birds move about a good deal, apparently in response to availability and abundance of food, but are considered non-migratory in California. In Central and South America it may be migratory to some extent.

2. Food

The principal food is mice and other small mammals, but

occasionally small birds, lizards, amphibians, and large insects are taken. Concentrations of mice are an important factor influencing movements of this species.

White-tailed Kites hunt by flying at moderate height, hovering when prey is sighted, and dropping with legs extended and wings held up above the body. Most hunting is done in early morning and late afternoon.

3. Nesting

In favorable situations, several pairs of White-tailed Kites may nest rather close together. Six nesting pair were found in a 40 acre orchard and 18 pairs in three square miles of diked agricultural land. Abundance of rodents seems to be a primary factor influencing selection of the nesting area. The nest itself is placed in almost any suitable tree, 15 to 50 feet above the ground, which offers concealment from below. Live oaks are frequently chosen. The nest is built of twigs, rootlets, and dry grass, usually about 20 inches in diameter and eight inches deep. Construction varies from flimsy to substantial.

The average clutch is four or five white or creamy-white eggs heavily marked with rich browns. The incubation period is about 30 days, with both parents participating. Another 35 to 45 days is required for fledging. Renesting will occur if the first clutch is lost, and there seems a possibility that two broods are sometimes raised.

4. Limiting Factors

White-tailed Kites are normally unsuspicious and unwary so that in past years a good many were doubtless killed indiscriminately. Abundance of small rodents, which experience extreme population fluctuations, is a major factor in determining Kite abundance and distribution. Recent trends in habitat alteration have been beneficial since this species prefers open and semi-open conditions such as irrigated crop lands and pastures or grass lands with scattered trees. Wide scale rodent control programs reduce food supplies for the Kite and thus affect its numbers, but pesticides do not directly affect this Kite to the same degree that they affect species which feed upon birds.

5. Management

Since it seems that the main limiting factors on White-tailed Kites have been direct losses to man, abundance

of small rodents, and suitable open and semi-open habitat, these must be considered in any management program. Today the necessary legal protection exists, and public attitude is generally good. Continued good law enforcement is essential.

Drastic, widespread rodent control programs are inimical to White-tailed Kite populations so that any area managed for Kites should be treated to encourage an abundance of small rodents. Extensive open and semi-open areas of grasslands, agricultural lands, irrigated fields, and marshes will provide the necessary habitat.

III. Relationship to National Forests

White-tailed Kites are extremely limited in the Southeast. Recent Florida records are Vero Beach, Lake City, and Shalimar (Okaloosa County). One was seen ten years ago near Selma, Alabama, and there are a few records in South Carolina 1929-1953, plus one in 1972. One was observed at Grand Isle, Louisiana, in 1969. Texas records are much more numerous and include Lower Trinity River in Liberty County (nesting), San Antonio, Freeport, Rockport, San Benard Refuge, Brazoria Refuge, Santa Ana Refuge (nesting), Bentsen State Park, Galveston County, Freestone County, Laguna Atascosa Refuge (nesting), Welder Refuge, Bolivar Peninsula, La Sal Vieja, and San Benito (nesting). Greatest numbers occur in the Rio Grande delta where it is fairly common.

On the basis of these data, it appears that White-tailed Kites have only a very casual relationship to any of the National Forests in the Southeast. The Liberty County nest is only about forty miles from the Sam Houston, however, and it is always possible that White-tailed Kites could occur on this or other Texas National Forests. One of the South Carolina records was very close to the Francis Marion, and one of the Florida records close to the Osceola. It is likely, however, that occurrences east of the Mississippi will continue to be very sporadic. For these reasons, specific management for White-tailed Kites on National Forests in the Southeast can hardly be justified. Where the bird does occur it should be fully protected.

SWALLOW-TAILED KITE
Elanoides forficatus forficatus (Linnaeus)

I. General Distribution and Status

The former general range of the Swallow-tailed Kite extended over the Mississippi Valley and Southeastern United States and most of South America southward into Argentina and southern Bolivia. The South American race has been separated as Elanoides forficatus yetapa, but the demarcation is not well defined since most of the birds which summer in the United States, Mexico and Panama migrate into South America to winter.

Until the latter half of the nineteenth century this species was a widely distributed and fairly common breeding bird over the Southeast and throughout much of the Mississippi River basin as far north as Minnesota and Wisconsin. By the early 1900's, the Mississippi Valley population had declined drastically and without known cause. The United States range now seems to be very largely limited to the coastal States from North Carolina through Texas. Within this area it is rare and local with most birds being found in south and central Florida.

II. Life History and Habitat Requirements

1. General

The Swallow-tailed Kite is one of the most graceful and elegant birds to be found anywhere. It is handsome in coloration and appearance and truly amazing in flight. It seems to spend most of its waking hours in the air - hunting, feeding and drinking are all done on the wing. One can hardly see this bird in the field without being impressed.

2. Food

Swallow-tailed Kites feed mainly upon small reptiles, amphibians, and insects. These are captured and eaten in flight, which gives some idea of the Kite's grace and agility, for the commonly taken foods include tree frogs, lizards, grasshoppers, dragonflies, cicadas, bees, and a variety of other insects. Hunting is done both among the trees and over marshes or grassy areas. Sometimes young birds or eggs are taken from nests.

3. Nesting

Nests are generally placed in the tops of very tall

trees, 60 to 150 feet or more above the ground. In the Southeast these are generally pines or cypress while in other sections cottonwoods, sycamores, oaks, and birchs are used. They are built mainly of cypress twigs, especially those covered with lichens, and Spanish moss. In the upper Mississippi Valley range large twigs, lichens, and long moss made up the nest materials. Nests seem to vary a good bit in size and shape, some being almost flat while others are well cupped. They may be oval in shape, about one by two feet, and only a few inches thick, to two feet in diameter and a foot thick.

The usual clutch is two or three eggs. These are white or creamy white irregularly blotched or spotted with dark brown. The incubation period is apparently about 23 days. Both parents share in this and in caring for the young.

4. Limiting Factors

It is not really known what factors operate to limit populations of the Swallow-tailed Kite. The decline and final disappearance of the Mississippi Valley population was well observed but the causes involved were not discovered. In some situations shooting and other direct losses may have been a factor but others must have been involved. Habitat changes can always have an effect, but the known requirements of the Swallow-tailed Kite still seem capable of being met. It is possible that this species has some undefined intolerance of man and his activities and that the increase in human populations had indirectly caused the decline in Kite populations.

5. Management

Management programs for the Swallow-tailed Kite can only be suggested in general terms. Protection and prevention of direct losses and harassment are essential. Extensive areas of suitable nesting and feeding habitat relatively free from human activity also seem to be necessary. Suitable nesting habitat now seems to consist largely of cypress swamps or strands with adjacent tall pines. Abundance of food requires a well-balanced, healthy habitat which will produce good supplies of insects, amphibians, and small reptiles.

III. Relationship to National Forests

At present the coastal states from North Carolina through Texas constitute the principal range of the Swallow-tailed

Kite in the United States. Recent records include:

North Carolina - Mattamuskeet, Hatteras Island, Stonewall, Atlantic, Nags Head, Beaufort, and Pea Island. Prior to 1900 it occurred in late summer and early fall in western North Carolina.

South Carolina - Huger, Laurens County, Santee National Wildlife Refuge, Santee Delta, Jasper County, Charleston, and Francis Marion National Forest.

Georgia - Augusta, Lower Altamaha River, and Wheeler County.

Florida - Alligator Point, Lakeland, Panacea, Pensacola, Flamingo, Winter Park, Liberty County, Apalachicola, northern Polk County, Carrabelle, Jacksonville, St. Marks, Sopchoppy, Medart, Tampa, Sarasota County, Lake County, Lake Pierce, Havana, St. Teresa, St. George's Island, Rockledge, Highland Hammock State Park, Sanibel Island, Cocoa, Key West, Homestead, Daytona Beach, Navarre, Fisheating Creek, Big Cypress Swamp and Ocala National Forest.

Alabama - Stockton (Baldwin County), Dauphin Island, Demopolis, Mobile, Leroy (Washington County), Weiss Lake, Cherokee County, Auburn, Waverly (Lee County), and Clarke County.

Louisiana - Hackberry, Grand Terre, Pearl River bottoms, Sabine River bottoms (Beauregard Parish), New Orleans, Pass a Loutre, Krotz Springs, St. Charles Parish, Catahoula Parish, and Lafayette.

Texas - Aransas Refuge, Cove, Denton County, Refugio County, Welder Refuge, Houston, Baytown, Rockport, Washington County, and Austin.

In addition to these States, there are a very few recent records for Oklahoma and Tennessee.

From these data it is apparent that the three Florida National Forests and the Francis Marion are very important to the Swallow-tailed Kite. The Francis Marion probably has the largest breeding population of any similar sized area outside of Florida. Here the species deserves special consideration in regard to habitat preservation and protection from disturbance. A close check should also be maintained on the Ocala and Apalachicola National Forests to keep up-to-date on the status of the Swallow-

tailed Kite there so that habitat preservation areas can be defined. The Osceola, Kisatchie, Sabine, and Angelina National Forests are located in areas of potential Kite occurrence and the bird should be looked for there although present lack of use indicates no needed program at this time.

HARLAN'S HAWK
Buteo jamaicensis harlani (Audubon)

I. General Distribution and Status

The taxonomy and nomenclature of Harlan's Hawk have long been unsettled, and at various times it has been considered a distinct species while at others it has been considered a subspecies of the Red-tailed Hawk. The Thirty-second Supplement to the A.O.U. Checklist treats it subspecifically as indicated here. Harlan's Hawk shows light and dark color phases, with numerous intergradations, so that it is rather difficult to separate from some others of the Red-tailed Hawk group. In this subspecies the tail is typically rather whiteish or gray, marbled with dusky.

Harlan's Hawk breeds in Northern Alberta, British Columbia east of the Coast Ranges, and adjacent southern Alaska. It winters in Arkansas and nearby States. This birds seems reasonably common, for a raptor of its size, in the summer range. In the winter range it may be unrecognized or overlooked, but is generally considered as rather uncommon.

II. Life History and Habitat Requirements

1. General

In the summer range, Harlan's Hawk is generally found in timbered country. It is reported to be fairly common, but extremely wary, often perching in the tallest trees so that it has a commanding view of the surrounding country.

In winter it prefers a mixed habitat of pastures, fields, woodlots, bluffs, and streamside woods. It is more or less territorial in winter, usually by pairs, but sometimes in small groups. Night roosts in thick conifers are frequently used. During winter days about 7 1/2 hours of the available 9 hours of daylight are spent in hunting. Two to three hours per day are spent on some high perch.

2. Food

Harlan's Hawk feeds mainly on small mammals such as rats, mice, rabbits, ground squirrels, and chipmunks. Some birds such as meadowlarks and some lizards, snakes, and large grasshoppers are also taken. Hunting is done from a perch or in flight.

One immature bird was observed to make five kills in

21 days. During this time it was without food for 13 days, once for a five day period. It's intake was about 100 grams per day, but general averages would probably be higher. Birds in captivity in winter averaged 135 grams per day.

3. Nesting

Harlan's Hawks usually nest in high trees, often using the same nests year after year. The structure is large and bulky, built of sticks and twigs and lined with bark and other fibers. Occasionally nests are built on rock ledges. The territory of a nesting pair varies from one-third to two and a half square miles.

Both members of the pair build the nest in early spring, then the female spends much time around the nest for several weeks before egg laying begins. During this time the male often brings food to the female and green twigs to the nest. Among the Red-tailed Hawk group the usual clutch is three or four eggs. Accounts of Harlan's Hawk nesting in British Columbia, however, mention only two young in several nests. The incubation period is about 30 days.

4. Limiting Factors

Little is known concerning the specific limiting factors of Harlan's Hawk. Adequate perching and nest trees are vital as is an adequate food supply. Direct losses to man probably limit populations in some areas. Pesticide effects may also limit populations but are probably not so marked as in some other birds of prey. However, large scale rodent control programs very likely limit the availability of foods so that in one way or the other use of these chemicals may well affect population levels.

5. Management

No very specific management measures can be suggested for Harlan's Hawk, especially in the winter range, except the obvious one of protection against direct losses and disturbance by man. A general mixture of upland habitat types will provide suitable territory provided adequate food is present. This can be assured only through maintenance of a healthy, well-balanced environment.

III. Relationship to National Forests

The winter range of Harlan's Hawk is considered to be Arkansas and adjacent States. In Arkansas it occurs regularly, especially in the northwest part of the State, but is not common. Eastward to Alabama it is quite rare, there being

only a very few records for that State and Mississippi. It is an irregular winter visitor in west Tennessee, again uncommon. Likewise, there are only a very few recent records for Louisiana. In Oklahoma it is a fairly common winter resident in the eastern part of the State. There are numerous records from Texas, but they do not indicate any abundance.

Specific location records for Arkansas are: Brinkley, Holla Bend Refuge, Lonoke, Ft. Smith, Jonesboro, Clay County, Fayetteville, Springdale, Moffett, and Pine Bluff. For Texas these are: Dallas, College Station, Brazonia Refuge, Cove, Muleshoe Refuge, Lewisville, Houston, Freeport, Eldorado, Del Rio, Fort Worth, La Sal Viejo, New Braunsfels, and Travis County. For Oklahoma: Ripley, Classmore, Oklahoma, Washington and Roger Mills Counties; Oklahoma City, Norman, Hulah Reservoir, Salt Plains Refuge, Tulsa, and Stillwater.

Of the National Forests in the Southeast, therefore, the Ozark and Ouachita are of most importance to Harlan's Hawks. The Caddo and Cross Timbers National Grasslands can be expected to be important also, although occurrence of these birds was not definitely confirmed. The four Texas National Forests and the Kisatchie may sometimes be used but Harlan's Hawk has not been observed there.

Where this bird occurs on the Ozark and Ouachita National Forests it should be afforded protection and freedom from disturbance. If it shows up on the other Forests or on the Grasslands it should be given like treatment.

SHORT-TAILED HAWK
Buteo brachyurus (Vieillot)

I. General Distribution and Status

In the United States the Short-tailed Hawk's usual range is confined to Florida. Otherwise, it occurs from central Mexico south through Brazil, Misiones Province in Argentina, Paraguay, eastern Peru and Bolivia, and in the temperate zone of the Andes south to the Provinces of Valdivia, Malleco, and Atacama in Chili.

Differences of opinion exist regarding the nomenclature of the Short-tailed Hawk. Some consider the bird of North America south to Panama as Buteo brachyurus fuliginosus while the South American birds occurring below the 7,000 foot elevation are called Buteo brachyurus brachyurus. Those found in the Andean portion of the range above 7,000 feet are called Buteo brachyurus albigula. In addition, some ornithologists are of the opinion that the Florida dark phase Short-tailed Hawks are not safely separable from Broad-winged Hawks with all-black underparts by appearance alone. The Florida birds seem slightly larger and slightly different in color from those found in Mexico and Central America.

The Short-tailed Hawk apparently has been a rare and local species in Florida ever since its discovery there, and it is usually considered to be uncommon throughout its range. It is listed as a peripheral species in the 1973 Edition of Threatened Wildlife of the United States, USDI. This means that its occurrence in the United States is at the edge of its natural range and that it is threatened with extinction within the United States although not in the whole range.

II. Life History and Habitat Requirements

1. General

In Florida Short-tailed Hawks utilize areas of mangrove, cypress, and thick hardwoods more than open areas or pinelands. In Mexico, the species frequents pine-oak ridges at about 6,500 feet elevation while in South America it is said to occur in areas of broken forests rather than in the dense lowland rain forests.

Short-tailed Hawks typically spend a good bit of time on the wing. They are expert fliers, sometimes eat while in flight, and often soar for hours. They

sometimes mix with vultures during these flights. Most of the Short-tailed Hawk's hunting is done while in flight as opposed to the Broad-winged Hawk's habit of hunting from low, exposed perches.

2. Food

Information on the food preferences of the Short-tailed Hawk is limited, but it is known to prey upon small birds and mammals as well as on lizards and insects. These may be captured either by means of a typical stoop or by a rather long shallow dive.

3. Nesting

Short-tailed Hawks' nests are generally built near the top of large cypress, gum, or magnolia trees or in the tops of mangroves or cabbage palms. In the latter situations they may be as low as eight feet above the ground but in the former are usually 40 to 90 feet above the ground. The nests are fairly large, two feet in diameter and about a foot in height, but are usually well concealed. They are constructed of small sticks, lined with Spanish moss and green cypress twigs and leaves.

There are generally two eggs, sometimes one or three. They are pale bluish white to dull white sometimes irregularly spotted or blotched with brown. The laying period usually begins in late January and extends to early May.

4. Limiting Factors

There is not enough information available on the Short-tailed Hawk to define its limiting factors. The species does not seem to have any very limited habitat requirements nor any strict dietary habits. Because of this, it is very difficult to determine what limits the population of this species, but whatever the factor or factors involved they must have been operative for a very long time for Short-tailed Hawks have always been rare in the United States.

5. Management

Because of the lack of information on limiting factors and habitat requirements, only very general management practices can be suggested. Of first importance, is strict protection of all individuals and nests from any harassment, disturbance or direct loss. As with any species, sufficient suitable habitat is a basic requirement. In this case the kinds of habitat utilized seem

quite general and widely available, so no specific management seems indicated. It is necessary to retain extensive areas of hardwoods, cypress, and mangroves in natural, healthy condition.

III. Relationship to National Forests

Except for one 1966 observation of a Short-tailed Hawk on Dauphin Island, Alabama, the species occurs only in Florida in the United States. Records in Florida include Coot Bay and Pine Island in Everglades National Park, Ft. Lauderdale, West Palm Beach, Royal Palm Hammock, Marathon, Grassy Key, DeSoto City (Highlands County), Palmdale, Ft. Myers, Frostproof, Dixie County, Citrus County, and Ocala National Forest. There is an 1889 nesting record for St. Marks.

The only National Forest of importance to the Short-tailed Hawk, therefore, is the Ocala. It presently occurs there very occasionally. It should be watched for very carefully and whenever found should be studied to learn the specific areas and habitat types utilized. This will allow the necessary protection to be provided and will possibly indicate additional management measures which can be undertaken.

GOLDEN EAGLE
Aquila chrysaetos

I. General Distribution and Status

The range of this species is holartic, extending as far south as North Africa, Arabia, the Himalayas, and Mexico. Five subspecies are generally recognized, but all tend to intergrade into one another. The North American subspecies is A. c. canadensis. Its range extends from Alaska across Canada to Newfoundland and Ungava, southward to central Mexico from the east slope of the Rocky Mountains to the Pacific, and from New Brunswick southward through the Appalachian Mountains. Non-breeding birds and migrants wander widely, and may be found considerable distances from the usual range.

The golden eagle is not included in the 1973 Edition of Threatened Wildlife of the United States, USDI. In Eastern New Mexico and the Trans-Pecos and Edwards Plateau regions of western Texas, known as winter areas for golden eagles, aerial censuses from 1964 through 1968 indicated populations ranging from two to 16 birds per 100 square miles. Aerial inventories of 769 linear miles of canyon walls in Idaho-Oregon in 1967 showed a total of 113 active and 199 alternate nests (Hickman, 1972). In past years several hundred birds were killed annually in predator control programs. In the eastern United States, however, it must be considered as rare. Its status in foreign countries is described in the following paragraphs.

The Golden Eagle is a resident in the Highlands of Scotland and on the Inner and Outer Hebrides. It is very rare elsewhere in Scotland. It does not occur in England, Wales, or Ireland except as a very rare vagrant. The breeding population is estimated to be about 200 pairs ("The Status of Birds in Britain and Ireland", D. W. Snow, Editor, 1971).

The population of Golden Eagles in France is estimated to be 80 to 90 pairs, of which about 50 are in the Alps, 5 to 10 in the Massif Central, about 20 in the Pyrenees, and 3 or 4 in Corsica (J. Dorst, pers. comm. 1972). The Swiss population is estimated to be about 70 pairs, resident throughout the Alps (P. Geroudet, pers. comm. 1972). In Austria it also nests in the Alps where there is a population of about 50 pairs.

In Germany the species is likewise confined to the Alps, in Bavaria. The estimated population is 15 to 17 pairs (G.

Rheinwald, pers. comm. 1972). It is very rare in Italy, but a few are thought to occur in the Alps. It is recorded only as a rare straggler in the Netherlands (K. H. Voous, pers. comm. 1972).

The Golden Eagle is resident in Lapland and northern Finland where the population is estimated to be about 80 pairs (von Haartman, pers. comm. 1972).

There are eight species of Aquila and one of Haliaeetus in South Africa. A. nipalensis, A. pomarina, and A. pennata are uncommon migrants. A. verreauxi is widely distributed through all the mountainous districts in stable numbers. A. rapax is generally distributed but tends to be somewhat sparse in the extreme south. A. wahlbergi is widely and generally distributed over the sub-continent except in the extreme south. A. fasciata occurs in low numbers in the Cape, Natal, Zululand, and Orange Free State. A. dubia is an uncommon resident in Natal, Swaziland, Transvaal, southern Mozambique, and Rhodesia. It apparently has never been common (J. Vincent, pers. comm. 1972).

The Golden Eagle, Aquila c. japonica, during the last ten years has nested in seven locations on the Japanese mainland (Y. Yamashina, pers. comm. 1973).

Neither Bald or Golden Eagles occur in South and Central America or New Zealand (C. A. Fleming, pers. comm. 1972; H. Sick, pers. comm. 1972; A. Johnson, pers. comm. 1972; M. A. del Toro, pers. comm. 1972; C. C. Olreg, pers. comm. 1972).

A subspecies of the Golden Eagle, A. c. daphanae, occurs in the Himalaya mountains of India. Its population in eastern Himalaya (Nepal, Sikkor, Bhutan, etc.) is reported to be steadily declining (Biswamoy, Biswas, pers. comm. 1973). The chief reason for this decline is thought to be destruction of the habitat of its prey.

Each year a few birds are observed in the mountainous portions of Virginia, North Carolina, and Tennessee as well as in central Tennessee and western Louisiana and east Texas. In Alabama one or two observations are made during the winter each year, mainly in the coastal plain. Fewer birds are seen in the Tennessee Valley and none on the Gulf Coast. It is very rare in Mississippi. Although the Golden Eagle is considered to be primarily a bird of mountainous regions, out of 35 observations in the States of North Carolina, South Carolina, Georgia, and Florida between 1962 and 1972, 18 were in coastal areas, and 10 were inland coastal plain and piedmont areas.

No nesting has been completely confirmed in the Southeast although there are indications that nesting has sometimes occurred in North Carolina and Virginia.

Number of observations and seasonal variation in Golden Eagle occurrence in Florida, Georgia, North Carolina and South Carolina are shown in the following graphs and State summaries.

Florida

Florida has had so few occurrences that no real comparison can be made. Those observations that were recorded were all in the winter, two from St. Marks Refuge in Wakulla County having no particular dates, and the single bird from Brevard county occurring on March 24.

The Golden Eagle can reasonably be considered to be such a rare and erratic visitor to Florida that there can be no particular time to expect its arrival.

Georgia

A more established pattern of seasonal occurrence can be drawn for Georgia. Of the reports giving exact dates, seven were from the fall of the year as opposed to three birds in the summer.

Fall occurrence began on September 21 with the heaviest concentration coming from November 10 to November 26. The latest fall report was on a Christmas count.

Summer occurrences began on April 29 with other reports being labeled merely "summer".

It would be safe to expect the Golden Eagle to occur primarily in the later part of November although in Georgia it is also an extreme rarity.

South Carolina

The seasonal breakdown for South Carolina shows an almost even distribution. Seven birds occurred in the fall of the year beginning in September with the concentration coming in January and February.

Springtime notes on the Golden Eagle show that the majority, perhaps by coincidence, occurred early in May.

Several notes had no dates, particularly those from Sandhills Refuge at McBee, South Carolina, which were probably made on the mid-winter waterfowl inventory.

Generally it can be said that the bird is a great rarity in the State, but is more likely to be seen in mid-winter.

North Carolina

North Carolina's record of the Golden Eagle favors winter visits. There were six fall records versus three summer. Here again the data from the PeeDee National Wildlife Refuge had no specific dates, but it seems likely that they are from the mid-winter inventory.

The summer list shows one bird in July and two others merely as "summer". The winter list has one for "fall" and one each for late November, January, and March, with two in February.

In general it must be said that the Golden Eagle is such an extremely rare visitor to all four states that no particular season can guarantee a sighting. Records do seem to indicate that this great bird does tend to occur more often in winter than summer.

II. Life History and Habitat Requirements

1. General

This species generally frequents mountainous country, and utilizes home ranges as large as 200 square miles per pair in northeast North America and as small as 20 square miles per pair in the Western States. The home ranges are not closely defended, and there may be some overlap between adjacent occupied ranges. The reason for the considerable variation in range size seems to be related to the amount of open, hunt-able country which the range encompasses.

The Golden Eagle is a splendid flier, and will soar for hours among the updrafts along mountain ridges. After circling high into the sky, it will glide down in a long slant, probably reaching speeds of 120 miles per hour. In past years Golden Eagles were accused of preying heavily on domestic kid and lambs, and many birds were killed in predator control programs.

2. Food

Mammals are the preferred food, but birds form a considerable proportion of the diet, and carrion is also regularly taken. Large birds such as geese, turkey, or cranes may be struck in the air, but most of the prey is taken on the ground. The commonest method of hunting is by quartering slopes, coming suddenly over ridges to drop on prey surprised in the

open. Mammalian food, consisting of rabbits, ground squirrel, prairie dogs, and similar sized animals, often constitutes 90% of the diet.

Studies of prey remains in Golden Eagle nests in Texas and New Mexico (Mollhagen, Wiley, and Packard, 1972) showed that 70% of the nests contained remains of sheep or goat. It was not possible to determine whether these animals were killed by the eagles, or brought to the nest as carrion. Among the other large mammals reported taken are sheep, pigs, deer, and antelope. Again, it is usually difficult to determine which are taken as carrion. In this connection, tests of the lifting ability of Golden Eagles, conducted by Walker et al (1940), are of interest. The eagle easily flew 162 yards when carrying two pounds. With four pounds it flew 64 yards, and with eight pounds, 14 yards. There is a question, of course, as to how a captive specimen compares with the wild.

3. Nesting

Golden Eagles breeding in the northern part of the range migrate south in winter, while those of more temperate climates remain on their home range all year round. The nest is usually built on a mountain ledge or in a cliff, but may be in a tree. Each pair has a number of nests, perhaps as many as ten but usually two or three. Nests are used year after year, sometimes in rotation, and may become very large. The largest tree nests are 17 feet deep and four feet across. On ledges they may be eight to ten feet across and three or four feet deep. Nests are built of sticks and branches up to one and a half inches in diameter, lined with leafy branches. The same general location may be occupied by several successive generations of eagles.

Usually two, but sometimes one or three, eggs are laid at three to four day intervals. The eggs are dull white, spotted and blotched with brown or red-brown. In southern portions of the range eggs are laid in late January and early February; in temperate Europe and North America, March; and in northern parts of the range, late May and June.

The female usually incubates alone, but in some pairs the male also takes part. Incubation takes about 40 days. In about 80% of cases where two young hatch, the elder, which hatched several days earlier kills the younger. For the first two weeks the young are carefully brooded, but after three weeks are left

alone most of the day. The young are feathered at 45-50 days, and usually begin to fly at 65-70 days. Breeding age is reached at four years.

4. Limiting Factors

Key habitat requirements for the Golden Eagle include suitable nest sites, great expanses of country relatively free of disturbance, and sufficient open land suitable for hunting. This bird shows a strong preference for mountainous terrain, and when found in other areas must be considered as wanderers. The present low populations are probably due to past control programs, other direct and indirect human disturbance, and reduced breeding success because of pesticide ingestion. Because of the Golden Eagle's reputation for preying on livestock, it has been subjected to heavy shooting and trapping. For example, out of the records in Georgia in 45 years, 14 birds were shot or trapped. In one sheep raising area in west Texas 4,818 eagles were shot from an airplane between 1941 and 1947. An estimated 800 were similarly shot in Wyoming and Colorado in 1970 and 1971.

5. Management

Because of the very erratic occurrence and small number of Golden Eagles which can be expected in the Southeast, it is probably not feasible to undertake any intensive management program. Certain measures, however, should be taken. The species must be fully protected, of course. Nest locations should always be safeguarded--no disturbance within at least a quarter mile. If an active nest is found, major disturbances should be kept half a mile away during the nesting period. No areas in the Southern Appalachians can be expected to support many birds simply because sufficient food and suitable hunting grounds are not present. Hunting grounds must be unforested, since most prey is taken on the ground. Such open areas can be maintained through management in conjunction with other programs.

III. Relationship to National Forests

National Forests in the Southeast Region containing apparently suitable habitat are the George Washington, Jefferson, Pisgah, Nantahala, Cherokee, and Chattahoochee. Observed occurrences in relation to National Forests in North Carolina, South Carolina, Georgia and Florida are as follows:

North Carolina

Anson County sightings came from the PeeDee National

Wildlife Refuge and have no direct relation to National Forest lands, although the Uwharrie National Forest is not far distant.

Hyde County records come exclusively from Mattamuskeet National Wildlife Refuge and again have no direct relation to National Forests. The Dare County observations come from Pea Island Refuge which is located on the Outer Banks just south of Oregon Inlet.

Golden Eagle Sightings in Western North Carolina

Golden eagles were sighted regularly between 1953 and 1958 in Haywood County on the headwaters of the Pigeon River of the Pisgah Ranger District. Birds were present year-round but no nest was ever located. A rarely observed "courtship flight" in which 2 eagles locked talons after a spectacular flying display and tumbled a thousand feet before parting was observed in 1955 by 3 persons experienced in eagle identification.

In 1954 an adult golden was captured by the resident Game Manager on North Mills River in the Pisgah Wildlife Management Area in Transylvania County and later released unharmed.

In December 1970, an immature golden eagle which had been nursed back to health was released in the vicinity of Sam's Knob on the head of the Pigeon River. Two other eagles were sighted the same day. In January of 1971, an eagle was sighted in this area. Two more sightings occurred in this area in August of 1973.

Another was sighted on the Blue Ridge Parkway in Transylvania County in February, 1973.

Other sightings were made at Joyce Kilmer Memorial Forest in Graham County in the summer of 1972, at Whitesides Mountain, Macon County October 1972 and at Standing Indian Mountain, Macon County in the winter of 1972.

Malcolm G. Edwards
Atlanta, Georgia

BALD EAGLE
Haliaeetus leucocephalus

I. General Distribution and Status

This eagle is restricted to North America. It occurs across the continent from northern Alaska, the south shores of Hudson Bay, to Ungava and Newfoundland south to southern Florida and Baja, California. It is found on Bearing Island and the Aleutian Islands but not on the Canadian Arctic Islands or Greenland. Present and former distribution are essentially the same.

Two subspecies are recognized, the southern bald eagle, H. l. leucocephalus, and the northern bald eagle, H. l. alascanus. The primary difference in appearance is size, the northern race being larger and heavier. Differences between the two races are not clear cut, and there is a gradual increase in size from south to north. The southern bald eagle is included in the 1973 Edition, Threatened Wildlife of the United States, USDI, and is on the official list of endangered wildlife, as amended May 19, 1972. The northern bald eagle is not considered to be rare or endangered. Recent population estimates of this race in Alaska place the number of birds at 35,000 to 40,000.

In the continental United States (excluding Alaska) the breeding population is estimated to be 750 pairs. This includes both races. The 1965 estimate of active nests of the southern race is about 235. There are no good estimates of early populations, but the decline since World War II has been pronounced. The west coast of Florida, Tampa to Ft. Myers, had about 75 breeding pair in 1946 and about 35 in 1964. About 200 breeding pairs in the Chesapeake Bay area in 1936 declined to about 70 in 1966. The nationwide January eagle count sponsored by the National Audubon Society indicated about 3,700 birds each year from 1961 through 1966.

These same January counts indicated four areas of greatest abundance nationwide. These are the upper half of the Mississippi Valley, the Northwest (Washington, Oregon, Idaho, and Montana), Florida and the Chesapeake Bay area. The Florida population represented about 15% of the national total, and the Chesapeake Bay population about 5%.

More recent surveys indicate about 30 active nests in Virginia in 1972, all in the Coastal Plains at least six or

seven in South Carolina (one in the Francis Marion Forest); two or three in Tennessee; five or six in the southeast Louisiana; and at least 230 in Florida. No other States were known to have active nests, but all had a few non-breeding or migrant birds. Louisiana reports 12 to 15 birds wintering on Toledo Bend Reservoir with a Statewide population of about 100. Mississippi records are primarily along the Mississippi River, although the species formerly nested on the Gulf islands.

Although the Bald Eagle occurs only in North America, the closely related White-tailed Eagle, Haliaeetus albicilla, occurs through much of Europe and Asia. Its status is summarized as follows:

The White-tailed Eagle is considered rare and accidental in France, and has almost disappeared from the Mediterranean except for a few pairs in Greece and Turkey. Finland and Lapland have breeding populations, but the species is considered near extinction in the former. It is rare in Sweden. The best population is in Norway, approximately 300 pairs. In the British Isles, the White-tailed Eagle is rare and irregular. Only four or five have been recorded in the past decade (D. Goodwin, British Museum of Natural History, pers. comm.).

In Iceland it was formerly more common than at present, but a considerable decrease occurred in the period 1880-1910. It has been totally protected since 1913, but the present population is estimated to be about 40 birds. Usually no more than 10 pairs nest each year (Gudmundssen, pers. comm. 1973).

The White-tailed Eagle nests in five areas in northern Japan, and seems to be increasing slightly. Some birds from Siberia are reported to winter in Japan each year (Y. Yamashina, pers. comm. 1973).

The related species H. vocifer of South Africa is common and generally distributed along the southern and eastern coasts. It seems to be increasing in population and expanding its range (J. Vincent, pers. comm. 1972).

II. Life History and Habitat Requirements

1. General

The Bald Eagle is usually found in coastal areas, or along lakes and rivers. During migration they occur along mountain ridges. The Bald Eagle is a typical sea eagle, usually seen soaring or sitting on a commanding snag along the shore. Pairs are often observed together. After nesting season they may

congregate in areas where food is more easily available, and then may roost in numbers in the same tree. Immature birds may likewise roost together during the winter. The Bald Eagle will winter as far north as open water and food are available, migrating out of more northern nesting areas. Returns from birds banded by Charles Broley show that many birds which nest in Florida migrate to the northeastern states and southern Canada in mid-summer and return in early fall. Returns from birds banded in Saskatchewan indicate some migration as far south as Texas and Arizona. Still, eagles are considered to be primarily resident species.

2. Food

Fish are the preferred food and staple item of diet when available -- either dead, dying, or caught alive. Carrion is readily taken. The Bald Eagle also catches some birds, especially waterfowl and coots, and some mammals. Eagles catch fish by swooping down from a perch, by flying back and forth or circling over open water then swooping and striking with the talons, or by wading and catching the fish in the beak. Also, eagles will often force the Osprey to drop fish, which then are caught in mid-air. Species of fish eaten include bullhead, bowfin, alewife, sucker, gizzard, shad, striped bass, herring, catfish, needlefish, gar, mullet, and sunfish. When hunting coot or waterfowl, eagles will repeatedly swoop, causing the prey to dive until tired out, then pick up these birds. In hunting small mammals, eagles will course back and forth with intermittent perching. Birds other than waterfowl are probably hunted in the same manner.

3. Nesting

The nest is usually built in a large tree but may be on a rocky promontory. The site is usually near water. The pair remains together as long as both are alive, and the nest is added to year after year. It may be as large as twelve feet high and over eight feet across, built of sticks and lined with softer material such as pine needles, other leaves, or Spanish moss. One nest site in South Carolina has been used for over 35 years.

Two eggs are normal, but there are sometimes one or three. They are plain dull white, laid at intervals of several days.

In southern Florida the eggs are usually laid in late fall or winter (November to January), and even further

north it often lays in March. Incubation in about 35 days, both parents sharing. Renesting may occur provided the eggs are lost early in incubation. Young eagles remain in the nest for ten to twelve weeks, and are fed by both parents. There is much antagonism between the young, and the weaker is often killed or starves. Newly hatched young consume an average of three-fourths of an ounce of food per day. When ready to leave the nest, the average consumption is three and three-fourths pounds per day (Retfalvi, 1965). Bald eagles mature slowly, requiring four or five years to gain adult plumage and reach breeding age. In captivity, birds have reached 50 years of age. Productivity varies considerably, and success rates from .14 to 1.8 young per nest have been reported. The figure from Florida is 1.6. Some pairs do not breed every year though they may remain in the vicinity of the nest.

Nest sites vary considerably. In the Southeast, nests are usually built in living pines, mainly slash or loblolly. Large, tall, old trees with big crowns, well branched, are usually selected. Such trees are seldom less than seventy years old.

Along the Great Lakes and in the upper mid-West, sycamore, shell-bark, hickory, and red pine, and white pine are most used. In the West, favored nest trees are Engelmann Spruce, lodgepole pine, whitebark pine, Douglas fir, Sitka spruce, and cottonwood.

Species and growth form of the understory or ground vegetation do not seem to be important. The nest tree itself is generally taller than any other trees nearby. Perch trees are apparently a necessary component of the nesting habitat. They may be located as far as one-quarter mile from the nest and define the nesting territory in a general way. The size of this territory also varies considerably. Studies in Alaska showed a range of 28 to 112 acres and an average of 57 acres. General observations in the southeast indicate similar sizes here.

Effects of human disturbance on nesting bald eagles are not very clear-cut. Similar levels of disturbance occurring at different times in the annual cycle will have greatly different effects. Tolerance is least during egg laying, incubation, and first several weeks after hatching.

4. Limiting Factors

A number of factors have contributed to the decline in Bald Eagle populations. Shooting still constitutes a major loss. Electrocution is frequent, but much less important. Loss of suitable nesting areas is probably significant. Severe weather sometimes has adverse effects. The greatest single factor at this time, however, is probably the lowering of reproduction caused by pesticide build-up in the food chain. The effect of such accumulation in eagles is an almost complete lack of production from many pairs. Another indirect factor which is difficult to evaluate is the reduction of food supplies caused by water pollution. Key habitat requirements for the Bald Eagle include suitable nest trees and roost sites, and water areas which can supply adequate supplies of suitable food, mainly fish. During migration the Bald Eagle will travel considerable distances from water and is then sometimes seen in the mountains, but at all other times shows a strong preference for coastal areas or for large inland water bodies. It does not tolerate much human activity, hence requiring relatively large areas with little disturbance.

5. Management

Protection of the birds themselves and their habitat seems to be the most practical and effective means of improving eagle populations. Communal roost sites should be protected from any sort of destruction and from human disturbance while they are being used. Nest trees with associated roost trees should be inventoried and mapped. Likewise, potential nest trees with suitable roost trees should be identified in the same manner. No activities detrimental to the character of the nest site should be carried out within one-quarter mile of the site as defined by the nest and roost trees. Activities such as timber cutting, stand improvement, site preparation, and road construction should not be conducted within one-half mile of nests during the time of egg laying, incubation, and first month after hatching. Controlled viewing by the public from blinds or similar concealment at a distance on one-quarter mile from the nest could be permitted except during this period of nesting activity.

III. Relationship to National Forests

National Forests in the Southeast Region which show the greatest amount of apparently suitable habitat are the Croatan, Francis Marion, Apalachicola, Ocala, and Sabine. Portions of the Ouachita around Lake Ouachita seem to be less suitable, probably because this reservoir is somewhat low in fishery production levels. Bald Eagles can be expected to occur on almost any other Forest but will generally be temporary visitors.

On all Forests, but especially those named above, there should be a continuing program to record eagle occurrences, to locate and map active nests, and to locate and map potential nest sites. All these locations should be treated in accord with the recommendations discussed in the section on management.

Consideration should also be given to developing a cooperative program with the Bureau of Sport Fisheries and Wildlife to establish new breeding populations on suitable National Forests. The Bureau already has facilities and experience in rearing eagles in captivity, and the National Forests afford considerable areas of unoccupied habitat. This combination would seem to offer opportunity for a joint program. It must be recognized, however, that with any species as prone to wander as the Bald Eagle, the probability of establishing a nesting population is very uncertain.

AMERICAN OSPREY
Pandion haliaetus carolinensis (Gmelin)

I. General Distribution and Status

The osprey, or fish hawk, is distributed almost worldwide, but is more common in the Northern Hemisphere than the Southern. There are five subspecies. Pandion haliaetus carolinensis is the breeding bird of the North American continent. Its range extends from northern Alaska east to southern Labrador and Newfoundland, south to Baja California and south Florida. It does not nest south of Baja California and south Florida, but winters from the southern United States to the Caribbean Islands, Paraguay, Argentina, and Chili. Pandion h. ridgway, Maynard is resident in the Bahama Islands, possibly Cuba, Yucatan, and British Honduras.

The American osprey apparently has been subject to noticeable fluctuations in population for many years. Between 1882 and 1937, 81 nests in Massachusetts and Rhode Island disappeared. Of approximately 150 nests near Old Lyme, Connecticut, in the mid-1940's, 13 remained in 1965. A colony on Gardiners Island, New York was estimated to have between 150 and 200 nests during the period 1908-1911, and over 300 nests in 1932. Lake Istokpoga, Florida had at least 75 nests in 1910. In the mid-1960's populations in six of seven study locations from south Florida to New England and Wisconsin seemed to be declining at rates from 2% to 14% annually. The Florida Bay population appeared to be stable.

This general decline seemed to slow down in the years 1970-72, and some areas have begun to show improved production. The recruitment rate of the Gardiner's Island, New York population increased from 0.06 in 1966 to 0.66 in 1970, for example. Still, the status of osprey populations in the United States is rather precarious. It is listed among the status-undetermined birds in the 1973 Edition, Threatened Wildlife of the United States, USDI.

II. Life History and Habitat Requirements

1. General

Although the osprey has a very wide distribution it actually occurs in rather limited areas and is absent from many portions of its geographic range. It is usually found in coastal areas or in the vicinity of large inland waters.

In all the northern portions of its range the osprey is migratory. Along the Gulf coast and in Florida the species is present all year. Birds which nest in New England and the Middle Atlantic States reach these areas in late March and early April. Fall migration takes place in September and October. These birds seem to move on a broad front, from the Atlantic Coast inland to the Appalachian Mountains and down to the Gulf Coast. The migration route then leads through the West Indies to South America. Birds which nest in the Mid-West and North Central States move south to the Gulf, thence toward South America via the east coast of Mexico or the West Indies. About 14% of the North American ospreys winter in the West Indies and the remainder disperse across much of South America, especially along the north coast and in the major river systems.

Recent banding analyses have indicated that first year birds do not return to their nesting areas but remain on the wintering grounds for at least sixteen months. Two year old birds do not lay eggs, but may engage in nest building. Band returns and field observations of such birds indicate that they comprise 5% to 10% (average 6.2%) of the population present in nesting areas. The remainder of the two-year-olds remain in the wintering areas with the first-year birds. Approximately 90% of the three-year and older birds return to nest in the same general area in which they were raised.

Ospreys have a powerful flight though they usually appear to be rather slow. They often soar, and hover when preparing to dive.

Ospreys are quite tolerant of humans, and will often nest and live close to human habitation and activities.

2. Food

The osprey feeds only on fish. These are caught by diving from heights of up to 50 feet, usually after hovering at least momentarily over the prey. Generally only live fish are taken but sometimes dead fish will be fed upon if fresh. When diving, the osprey strikes the water breast first, with wings extended upward, and seizes the fish in its talons. Very occasionally the dive will carry an osprey almost under the water. Once caught, the fish are carried in the bird's talons to a perch or empty nest to be eaten in leisurely fashion. It is not uncommon for bald eagles to harass

ospreys carrying fish until the osprey drops its prey which is then caught by the eagle.

Ospreys will feed upon almost any kind of fish which swim close enough to the surface to be caught. These include menhaden, gizzard shad, mullet, catfish, carp, weakfish, herring, sunfish, and numerous others.

3. Nesting

Osprey are not overly particular about nest sites since they may be built in trees, on utility poles and similar structures, in bushes, on stumps, and even on boulders. The great majority of nests, however, are placed in trees. Most nests are reasonably close to water, but some are several miles distant. In the New England and Middle Atlantic States the tree species used include pines, oaks, sycamore, locust, elm, maple, and cedar. In the Southeast, pines and cypress are preferred. The nest is usually 50 to 60 feet above the ground, but may be as much as 100 feet, and the tree is almost always dead.

Ospreys remain paired for life, and the nest is used year after year. It is added to each year, so that it becomes a huge mass of sticks, moss, corn stalks, marsh grass, clods of dirt, sod, seaweed, and almost anything else the birds can carry. These nests may be eight to ten feet in diameter at the bottom, up to eight feet high, and four feet across the top. As the old material decays and new material is added, the nest becomes very heavy and may eventually break the tree down. Still, some nests last as long as 40 years.

Ospreys usually lay three eggs, very occasionally two or four. They are white to pinkish white, heavily spotted or blotched with dark browns or reddish browns. Incubation begins with the laying of the first egg, seems to be carried out by the female, and requires 28-32 days. Only one brood is raised per year, although a second clutch will usually be laid if the first is taken.

The female cares for the young in the nest for about 30 days after hatching. During this time the male provides most of the food. The young are feathered at about 40 days and begin to fly between 50 and 60 days of age. They continue to roost on the nest for another week or so, and use it thereafter as a feeding platform.

4. Limiting Factors

The osprey is another species at the top of its food

chain, and as a consequence is another species showing the cumulative effects of continued pesticide and pesticide residue ingestion. Algae in a lake or river may contain such chlorinated hydrocarbon residues at rates of a few parts per trillion, but the worms which feed on these algae may have a few parts per billion. Fish which eat the worms will have residues of a few parts per 100 million or 10 million. None of these may exhibit any ill effects, but ospreys which feed on the fish may build up residues of 3.5 to 20 parts per million. These levels then will have observable adverse effects on reproduction and reproductive success. It is likely that such buildup of pesticide and pesticide residues have constituted the primary limiting factor on osprey populations during the past 15 years.

Other factors which may be involved are a lack of suitable nest trees in some locations, and a lack of a suitable and adequate food supply in others. Direct losses to man, harassment, and disturbances are probably of lesser importance. There is always some loss to shooting and willful disturbance, but in many areas the osprey is welcome and protected. Natural enemies are minimal, and intraspecific competition seems to be very slight. In suitable locations nests may be placed as close together as eight or nine nests in an area of 100 acres.

5. Management

If, as the evidence strongly indicates, the cumulative effects of ingested pesticide and pesticide residues are the primary limiting factor on osprey populations, then continued efforts to reduce these chemicals in the environment are of greatest importance in osprey management. In all cases the restrictions on use of the chlorinated hydrocarbon and other broad spectrum, persistent pesticides should be followed. There are indications from the European countries which restricted these pesticides earlier than we did that hawk populations do begin to increase after a few years.

Aside from the pesticide problem, management efforts should be concerned with protection, food supply, and nest sites. The legal basis for protection already exists in this country, but protection must be made more fully effective through public education and information programs and through continued enforcement. Adequate food supplies can best be assured by maintaining

healthy, varied, aquatic habitats which will produce the needed fish. Such conditions cannot be achieved on a broad scale through isolated management efforts but only through diligent and widely supported measures to maintain a cleaner environment.

On the other hand, specific measures can be taken to insure adequate nest sites. Preferred sites, large old trees near water, are subject to destruction because of large-scale coastal housing developments. Osprey are tolerant of humans, so housing developments and allied construction can be done in such a way as not to destroy nesting sites, but unfortunately wholesale land cleaning is often the first step in any of man's construction activities. Destruction of nest sites also sometimes occurs as a result of forest management operations which involve clearcutting and short rotation even-aged management. Even where nest trees are left, removal of protective surrounding trees often leads to premature loss of the nest tree in high winds. Normally the pair would move to another nearby tree in such a case, but this is often not possible anymore because other suitable trees were taken out as part of the cutting prescription or for safety reasons.

Fortunately, otherwise suitable habitat can be made useful to ospreys by providing artificial nest sites. In the New England States it has been a fairly common practice for many years to provide such sites by fastening a wagon or cart wheel to the top of a suitable pole.

More recently, nest structures consisting of a framework platform of treated 2 x 4's atop 20-foot and 14-foot creosote treated poles were erected on the Glenn L. Martin National Wildlife Refuge, Smith Island, Maryland. In 1968, 10 of 12 structures were used, and in 1971 20 of 24 structures were used. Spacing between structures varied from about 200 yards to half a mile, and all were between 50 and 150 feet of a shoreline or tidal creek.

III. Relationship to National Forests

The osprey is a nesting and migrant species in all the Southeastern States. The Chesapeake Bay sections of Maryland and Virginia are among the more important areas for this species on the Atlantic Coast, but the rest of the coastal portion of these two States are very important also. Active nests were reported this year on Fisherman Island, Martin,

and Blackwater National Wildlife Refuges. Other recent reports from Virginia include Dayton, Hopewell, Northern Neck, Chincoteague, Staunton, Arlington, Cape Charles, Clarke County, and Back Bay.

In North Carolina it is considered to be still common on the coast, but rare inland. Recent records include New Bern, Wilmington, Beauford, Durham, Greenboro, High Point, Raleigh, Kerr Scott Reservoir, and Wrightsville Beach. Active nests were reported this year from Mackay Island and Mattamuskeet National Wildlife Refuges.

The coastal portions of South Carolina and Georgia are likewise the most important sections of those States for ospreys. A colony of 40 to 50 pair nests near the mouth of the Santee River in South Carolina, and this year nesting was reported from the Santee National Wildlife Refuge. Other recent reports include the Francis Marion National Forest, Columbia, Anderson, Hilton Head Island, Pawley's Island, Charleston, and Ravenel. Similar recent reports for Georgia include Sapelo Island, Glynn County, and the National Wildlife Refuge at Wassaw Island, Blackbeard Island, Harris Neck, and Okefenokee. The latter had at least eleven active nests in 1973.

The osprey is well distributed throughout Florida, generally considered to be a permanent resident. At least 80 pair nest in Brevard County. Good numbers are reported from Stuart, Vero Beach, Fort Pierce, Key Largo, Plantation Key, Marathon, Grassy Key, Sanibel, Captiva, Sarasota, Coot Bay in Everglades National Park, Ft. Myers, Naples, Volusia County, Englewood, the Lower Keys, south Dade County, Carnestown, and Merritt Island. Less abundant but regular occurrences are reported from Sanford, Orlando, Bradenton, West Palm Beach, Kissimmee, Lakeland, Lake Wales, Myakka State Park, Panacea, St. Marks, Gainesville, Jacksonville, Mt. Dona, and Pensacola. In 1973 there were active nests on St. Vincent Island, Lake Woodruff, Merritt Island, and Chassahowitzka National Wildlife Refuges.

In Alabama the osprey was formerly common in the spring and uncommon in the fall throughout the State. It nested on the Gulf Coast and in the Tennessee Valley. Recent records include the Tombigbee River near Jackson, Birmingham, Lee County, and Mobile Bay. Distribution in Mississippi is largely confined to the coastal area. It nests on the outer islands, but is rare inland. Recent records include Lauderdale County, Jackson County, Harrison County, Madison County, Cat and Horn Islands, and Noxubee

National Wildlife Refuge. In Louisiana the osprey is likewise most common in coastal areas. Recent observations include Venice and Natchitoches.

The species is considered to be an uncommon migrant in Arkansas. Recent records include Baxter County, Lawrence County, Mississippi County, Craighead County, Poinsett County, Clay County and Union County. In Oklahoma it is a regular spring and fall migrant and has been seen throughout the State. On the Texas Coast the osprey is a fairly common migrant and winter resident. Recent observations include Del Rio, Laguna, Atascosa, Santa Ana, Austin, Houston, Amarillo, Corpus Christi, Falcon Dam, Freeport, Welder Refuge, Galveston, Bolivar Peninsula, El Paso, Arkansas National Wildlife Refuge, and Old River.

In Tennessee the osprey is a fairly regular migrant and a breeding species in some areas. It nests on Chickamauga and Watts Bar Lakes, Reelfoot Lake, and along the Hiwassee River. Observations have been made on the Buffalo River (Lewis County), Nashville, Lebanon, Percy Priest Lake, Old Hickory Lake, Watauga Lake, Ashland City, Oak Ridge, Boone Lake, and Bristol.

On the basis of these records, it is apparent that osprey might occur as migrants passing over and temporarily stopping on almost any National Forest in the Southeast. There are several, however, which could provide regularly used habitat, including nesting habitat. These are the Croatan and Uwharrie in North Carolina, the Francis Marion in South Carolina, Ocala and Apalachicola in Florida, the Winn District of the Kisatchie in Louisiana, the St. Francis and Ouachita in Arkansas, and the Sabine and Angelina in Texas. On all of these, nest trees and potential nest trees should be retained along with any protective trees within a radius of 100 yards. Active nests should be protected from harassment, although a moderate amount of human activity does not disturb the birds. On any of these Forests where the shorelines of coastal water, large reservoirs, and major rivers and lakes do not have suitable nest trees, nest structures may be built to induce ospreys to establish breeding colonies. The Sabine and Angelina are good examples of such areas. Some portions of the Ocala might likewise be improved.

PRAIRIE FALCON
Falco mexicanus (Schlegel)

I. General Distribution and Status

This species is the prairie and desert counterpart of the peregrine, about the same size but lighter in color. It breeds from central British Columbia eastward to southern Saskatchewan and south to Baja California and northern Texas. The name may give a wrong impression as to its habits, for it occurs up to elevations of 11,000 to 12,000 feet. It winters throughout the breeding range and into central Mexico. Birds which overwinter within the breeding range frequently move to lower elevations during the cold months.

In past years the prairie falcon ranged east to Minnesota and Illinois. Wintering and migrating birds were recorded fairly regularly in the Dakotas, Kansas and Missouri. It is most abundant in eastern Washington and Oregon and in the mountains of California westward of the central valleys, but does nest as far east as the western portions of the Dakotas. In other localities it must be considered an erratic wanderer.

The prairie falcon was considered a rare species east of the Rocky Mountains in 1938. Now it is on the list of Threatened Birds of the United States - USDI, and has disappeared from many localities within its range. No population estimates are available.

II. Life History and Habitat Requirements

1. General

The prairie falcon is usually considered to be a bird of wide open spaces. In many respects it is similar to the peregrine but tends to be even more wary and secretive. It likes to sit on dead trees and other perches which give it a wide outlook over its range.

Prairie falcons are probably nearly equal to peregrines in power of flight, and are superb predators. They capture birds by diving and striking or by seizing the prey in mid-air or from its perch. There are numerous accounts of prairie falcons harassing small birds apparently without trying to catch them. It has also been observed to take prey from marsh hawks in the same fashion eagles rob

ospreys of their catch.

2. Food

Food habits studies of prairie falcons are not so complete as for many other species, but available data show that while birds usually comprise the major part of the prey many mammals are also taken. Black-birds, meadowlarks, sparrows, dove, quail, shorebirds, and pigeons are probably the more common birds captured. Poultry are sometimes taken. Mammalian prey includes rabbits, ground squirrels, rats, prairie dogs, and gophers.

3. Nesting

Prairie falcon nest sites are usually located in cliffs or rock outcrops fifty to several hundred feet in height and generally perpendicular. The nest itself is usually in a small cave, crevice, or recess of some kind at least thirty feet above the cliff base. As always, there are exceptions, and some nests have been found in niches in earth banks. Preferred sites face out over open country, but the nest may be placed as deep as five feet in a crevice or recess. These choice sites tend to be used year after year. As a rule, no nesting material is used, although sometimes the falcons do nest in old raven nests. There is an old record from Missouri of a nest built in a tree.

In California, Oregon, and Washington four or five eggs is the usual clutch. Eastward of these States, clutches average three or four eggs. They are somewhat smaller and lighter in color than those of the peregrine. Usually one clutch is laid each year, but if the first is lost a second is generally laid.

Incubation is primarily by the female, and averages approximately 31 days for each egg. Hatching thus takes place over a period of several days. The young are brooded and fed in the nest for about five weeks. The last down is not shed until about eight weeks of age, after the young are already on the wing. During this time they remain more or less under parental care.

In very favorable situations, nests may be as close to each other as 600 feet when on cliffs facing away from each other. In one instance, 23 pair were found on 16 linear miles of cliffs.

An average of 1.2 young are fledged per nest. The first year mortality is estimated to be about 80%. Breeding age is at least two years.

4. Limiting Factors

Reasons for the population decline in the prairie falcon are largely speculative. It is probable that the same effects of pesticide ingestion operate in this species as in the peregrine. Information on egg shell thinning and pesticide residues in tissues are not available to confirm this, however.

Other factors which probably are involved include killing, capture and harassment during nesting by man as well as some habitat loss. These are doubtless less important than the effects of pesticides.

5. Management

Like the peregrine, the prairie falcon's basic requirements are an ample food supply, suitable nesting cliffs, and freedom from human interference. It does not seem to need water to the extent that the peregrine does. Probably the greatest limiting factor is the effect of chlorinated hydrocarbon pesticide residues ingested with food, while direct losses and habitat losses are of much less importance. Any effective management program must assure the basic requirements and reduce the limiting factors.

Again, the first action should be protection from direct losses and harassment. This is provided for by federal law and some State laws. Known nesting sites, and those cliff areas which in the past were used for nesting should be well protected. It is likely that many such areas will be on public lands. It is also likely that much of the suitable hunting range which can support the small bird and mammal populations necessary to the prairie falcon will likewise be on public lands. This should facilitate implementation of management programs.

At the same time, effects of pesticides remain the most critical limiting factor. Limitations on what chemicals may be used as pesticides, and how they are used, will doubtless continue to be the deciding factor in the success of any management program for the prairie falcon.

The possibility of breeding prairie falcons in captivity

are not known, but probably are not very good considering the lack of success with peregrines. No attempts have been made thus far to re-establish prairie falcons in unoccupied range.

III. Relationship to National Forests

The prairie falcon breeds sparingly in western Oklahoma and west Texas. A series of records beginning in 1966 shows it to be an irregular, casual visitor, mainly during winter, in the more eastern parts of these States. In all cases it must be considered uncommon, for seldom are more than a few birds reported in any one year.

It has been recorded a few times in Arkansas, Tennessee, North Carolina and South Carolina. The latter is one of the most recent observations (May 1973), but this bird could well have been an escape in view of its actions and lack of shyness.

None of this information indicates more than a very casual relationship of the prairie falcon to the National Forests of this region. It probably occurs fairly regularly as an uncommon, casual visitor during winter on the Texas Grasslands. The 1973 South Carolina record was very close to the Francis Marion National Forest, but as previously indicated this bird had probably escaped from captivity.

Considering the very few prairie falcons which may utilize the National Forests of the Southeast, it does not seem practical to institute a specific management program for this species. Individual birds which do visit should be fully protected. Limitations and restrictions on use of persistent chlorinated hydrocarbon pesticides should be completely followed.

PEREGRINE FALCON

Falco peregrinus anatum (Bonaparte)Falco peregrinus tundrius (White)I. General Distribution and Status

The peregrine falcon occurs around the world, being found as breeding residents on all of the continents. Twenty-two subspecies have been described, of which three are North American. These are Falco anatum, F. P. tundrius, and F. p. pealei.

The latter, Peale's peregrine, lives along the coasts of British Columbia and southern Alaska, including the Aleutian Islands. Its plumage is darker than the other two subspecies, and it may be slightly larger, but it has essentially the same habits and life history. Peale's peregrine is largely non-migratory within its range.

The Artic peregrine, F. p. tundrius is found in northern Alaska and across the Canadian tundra. It is in general somewhat smaller and lighter in color than F. p. anatum, which is called the American peregrine (as well as anatum and taiga peregrine). Both American and Artic peregrines are also called duck hawks. The American peregrine was originally distributed throughout the rest of Canada and Alaska south of the Artic peregrine range, the United States, and the northern half of Mexico. It apparently was always rare in the central plains of the United States. The breeding range in the eastern United States formerly included the mountainous areas from Maine to northeastern Alabama. Nests have also been found in northern Arkansas and northwest Tennessee. Now, it no longer breeds in the eastern States. A few breeding pairs remain in Labrador and the southern boreal forests of Canada, but the principal breeding range is the non-Artic portions of Alaska and Canada south to Baja California, central Arizona and Mexico eastward to the eastern front of the Rocky Mountains.

Although the peregrine falcon was never an abundant, common species, its numbers seem to have been fairly stable until the mid-1940's. Drastic declines have taken place since then. For example, a survey in 1946 showed approximately 100 pairs nesting successfully in California. In 1970 there were no more than five successful pairs. As a result of this decline, both the Artic and American peregrines are on the USDI endangered

species list. Continental populations are extremely difficult to determine, but the best estimates at present indicate approximately 2,000 breeding pairs of Artic peregrines, 300 breeding pairs of Peale's peregrine in the Aleutians, and perhaps no more than 200 breeding pairs of American peregrines in the continental United States, with an additional few hundred in Canada, Alaska, and Mexico.

All field and laboratory evidence points to the cumulative effects of chlorinated pesticides, ingested with food, as the principal cause for this decline. These chemicals and their breakdown products cause increased adult mortality and decreased reproduction including egg shell thinning. Habitat destruction and disturbance, especially in the East, are also likely factors.

II. Life History and Habitat Requirements

1. General

The peregrine is a truly magnificent bird. No other species combines such striking plumage, grace and power in flight, speed, and boldness in actions. Just to watch one is a memorable experience, so much so that the literature is full of accounts of its prowess in flight. The wingbeat is rapid, interspersed with long glides. In a dive, or "stoop", its speed is estimated to be over 200 mph. In level flight its speed ordinarily ranges from 48 to 62 mph. When hunting, the peregrine may either dive or simply catch its prey in mid-flight.

Falcons have been used by man for hunting since about 2000 BC. Traditionally the peregrine was reserved for the nobility because of its strength and spectacular performance. It is still highly valued as a hunting hawk, and consequently many falconers are extremely interested in the welfare of the species.

Both Artic and American peregrines are migratory but migration is much more extensive in the Artic. There are major movements of tundrius birds in spring and fall along the Atlantic coast and the Gulf Coast of Texas. Some of these birds move as far south as Argentina.

The home range of the breeding pairs vary tremendously, from as little as one quarter square mile to as much as 120 square miles. The average is about 20 square miles.

The pair generally remains mated for the life of the individuals.

2. Food

By far the majority of the peregrine's food is other birds. Almost any species from the size of a mallard down to warblers may be taken. Pigeons, passerines, birds, waterfowl, sea birds, and shore-birds are the more common prey. Birds are usually plucked before being eaten, and if food is abundant only the choice parts, such as the breast, may be used.

Food requirements are about 11-12% of body weight in warm weather and 15-16% in cold weather. Average daily food consumption is approximately 80-100 grams.

3. Nesting

Peregrine nests are almost always located on cliffs although there are a few records of tree nests in this country. The latter were in cavities of large cypress and sycamore trees 70 to 90 feet above the ground. Occasionally a nest will be built on a river cutbank or slope. Usually cliffs selected as nest sites are quite high, and frequently overlook water. The site is most likely to be in a hole, slit, or recess. Ledges are next most frequently used. Such ledges often have grass, lichens, or even shrubs and small trees growing on them.

Many theories have been considered, but so far there is no real answer to the question of why some apparently suitable cliffs are never used while others are used over and over again. Indeed, it is fairly obvious that there is a strong tradition of use associated with the more successful sites. Lichens and algae colonize the cliff faces below nests because of the birds' excretions, and often the nest ledges have a heavy stand of grass which other ledges lack. The number of different nesting ledges used by a single pair over a period of years is usually one or two, but may be as many as seven. These may be several miles apart. Renesting in the same year usually involves a change of site. Whatever the lapse of time, however, previously used ledges are the first to be reused.

The nest itself consists of a shallow scrape. It may be surrounded by a few twigs or pieces of grass. Ordinarily there are three or four eggs, rarely six or seven, laid at two to three day intervals. The ground color is creamy white to pale pink, but it is

largely overlaid with blotches and spots of rich browns and reddish browns. Usually one clutch is laid each year, but second sets will be laid if the first is lost.

Nesting began in late March or early April when the peregrine nested in the eastern States. In Alaska and Canada egg laying occurs from late May to late June. The female does most of the incubating and brooding, the male most of the hunting. Incubation averages about 32 days for each egg, and may range from 28 to 35 days. There may be as much as a two day interval between the laying of the eggs. The young remain in the nest six to seven weeks, and remain closely associated with the parents for another month after leaving the nest.

Breeding success may be as low as 15% of the eggs laid. Studies in Alaska indicated a production rate of 2.5 young per clutch.

4. Limiting Factors

Peregrines have few natural predators. There are a few records of raccoons and great horned owls eating eggs and young birds, and disturbance by any large animal may cause nest desertion.

Human activities have doubtless been a direct limiting factor. In past years collectors took both eggs and birds, and inadvertent nest disturbance continues to be a problem. Human habitation within a half mile of a nest may cause it to be abandoned, as will continued human activity around nesting sites.

Two diseases, trichomoniasis and botulism, occur in peregrines and cause some mortality. The hawks doubtless contract these diseases from infected pigeons, doves, and waterfowl.

Almost certainly, however, the most important limiting factor in peregrine populations is the organo-chlorinated pesticides which the birds ingest with their food. The marked rapid decline of peregrines in both North America and Europe began after World War II when these chemicals, especially DDT, came into extensive use. The decline in North America began about 1947, and increased greatly through the 1950's, especially in the East.

Continued ingestion of the chlorinated hydrocarbons causes either acute poisoning or sublethal chronic poisoning. The latter may have the more serious

consequences on the total population since adults suffering sublethal poisoning have very poor reproductive success. Effects include adverse changes in reproductive physiology and behavior, egg shell thinning, and reduced hatchability. These effects are most pronounced in the peregrine since it is the top predator in its ecosystem, and carries one of the highest levels of DDE residues of any known vertebrate. All peregrine materials and tissues measured so far contained residues ten to one hundred times more concentrated than in the prey species.

5. Management

The basic requirements of the peregrine are an ample food supply, water to bathe in, suitable nesting cliffs, and freedom from human harassment. The food supply must consist largely of small birds, sea birds and waterfowl although mammals are taken occasionally. Peregrines bathe frequently, and most nest sites are reasonably close to a river, lake, or stream affording shallow water areas such as gravel bars. Nests are most frequently placed in holes or on ledges of sheer to very steep high cliffs in isolated localities. It is true, however, that sometimes a peregrine will live for awhile among city skyscrapers, feeding on pigeons. In a few cases nesting was attempted on building ledges.

The primary limiting factors are pesticide ingested with food, and loss of nesting sites because of human interference and developments. The pesticide problem is much the more serious of the two.

Management programs must revolve around supplying the basic requirements, and reducing the limiting factors. This is extremely difficult in a wide-ranging species such as the peregrine. The first step, of course, is protection. The legal basis for this exists now, but a very necessary adjunct is public education to overcome indiscriminate and thoughtless harassment.

Adequate food supplies for the peregrine depend upon maintenance of a normal, varied bird population. This can best be provided for by land use that maintains a variety of habitat types in healthy condition. It is likely public lands will have to provide the majority of suitable habitat for the peregrine and its prey.

Since the critical factors in determining suitability of a cliff as a nest site are not known, it is not possible to define just what areas should be particularly

safeguarded. It is known, however, that previously used cliffs are the ones most likely to be used again. All such cliffs should be catalogued and protected from any sort of alteration.

Strict limitation on use of the persistent chlorinated hydrocarbon pesticides should be continued. The effect of such limitation will be slow to show up, just as the detrimental effects from their wide-spread use were slow to become evident. This one thing is doubtless the most critical factor in preventing extermination of the North American peregrines.

Attempts to raise peregrines in captivity have met with erratic success. No set of standard conditions has been worked out, and some pairs will breed while others will not in the same situations. Some produce fertile eggs, others not. Some will hatch eggs, others will not incubate but will care for young birds. As a consequence, no attempts have been made to reintroduce captivity-reared peregrines into unoccupied range.

III. Relationship to National Forests

The peregrine falcon formerly nested in the southern Appalachians, although population levels probably were never very high. If it becomes re-established as a breeding species in the eastern States, it can be expected to utilize suitable nest sites in the Jefferson, George Washington, Pisgah, Nantahala, Cherokee, and Chattahoochee National Forests. Likewise, it could possibly occur again on the Ozark National Forest.

While these possible occurrences are speculative, the status of this species warrants protection of potential nest sites in the Forests concerned. Those cliffs which appear to be suitable should be preserved from installation of structures, roads, or other facilities which would destroy them as nest areas. Intermittant use of such cliffs, as might be expected from hikers and climbers, would not be detrimental to the habitat. Even this use, however, should be eliminated for a distance of at least a quarter mile if there is any indication of nesting activity.

Peregrine falcons now occur as uncommon migrants and winter visitors over much of the southeast. The Atlantic and Gulf coasts generally have more birds than do the more inland areas. This is doubtless due to the generally greater abundance of prey such as shorebirds and waterfowl in the coastal areas.

Studies of migrating populations on Assateague Island, Maryland and Virginia, in 1970 and 1971 (Ward and Berry, 1972) indicated age ratios at that time were similar to those recorded since 1938. This is rather contrary to the situation with Canadian and Alaskan birds, and may mean that many of the Assateague birds, and hence those of more southerly coastal areas, nest in western Greenland. These birds may be subject to different kinds of stresses than are the Canadian and Alaskan birds. It is possible that the critical factors for this population operate in the migration and wintering habitat rather than in the nesting habitat.

Aside from the coastal records in Virginia, which are by far the more numerous, during recent years peregrines have occurred near Mt. Rogers, Pine Mountain, Passage Creek, Reddish Knob and Bridgewater.

Fall and winter observations in North Carolina include Doughton Park, Pea Island, High Point, Ocracoke Island, Lumberton, Raleigh, Fort Fisher, and Orange and Guilford Counties.

Recent South Carolina records include Magnolia Gardens, Cape Romain, Bull's Island, Francis Marion National Forest, and McClellanville. It is considered to be an uncommon winter resident.

In Georgia the peregrine falcon has been recorded in recent years on Sapelo Island and Watkinsville, both in mid-winter.

Florida records are quite numerous, although in most cases only single birds were sighted. East coast observations include Cocoa, Ft. Lauderdale, Vero Beach, Brevard County, Merritt Island, Sebastian Inlet, Indian River, and St. Lucie Counties, Ft. Pierce, West Palm Beach, Canaveral, Jacksonville, and Nassau County. West coast localities include Sanibel and Captiva Islands, Englewood, St. Joseph Peninsula, Alligator Point, Ft. Myers, Pensacola, and Panama. Central and southern locations include Coot Bay in Everglades National Park, Lakeland, Lower Keys, Dry Tortugas, Kissimmee Valley, and Sanford. The species is uncommon everywhere, but does tend to be more numerous on the East Coast and in Everglades National Park.

In Alabama it is rare and local with most observations made along the Gulf and secondly in the Tennessee Valley. In Mississippi it is considered a rare visitor at Noxubee National Wildlife Refuge and has been recorded in Pearl River County, Harrison County and Hinds County. It is

most likely to be found on the coastal islands.

Tennessee records include Nashville and Savannah. It is termed a very rare transient in west Tennessee.

In Arkansas the peregrine is likewise considered to be a rare fall and winter visitor. Recent records are for Lonoke, Mt. Magazine and Union County. Oklahoma records include Washita National Wildlife Refuge, Hulah Reservoir, and Stillwater. It is an uncommon migrant over much of the State.

In Louisiana the peregrine is a rare winter resident in scattered locations over the State but most likely to be found in coastal areas. There are numerous Texas records, mostly coastal but including Midland, College Station, Houston, Falcon Lake, Palo Pinfo, and New Braunfels.

These records show that at present time the peregrine falcon is an uncommon to rare migrant and winter visitor over much of the Southeast with greater numbers occurring along the coast. The Croatan, Francis Marion, Ocala, and Apalachicola National Forests are most likely to be used by these migrating and wintering birds, but they may sometimes occur on any Forest.

Little direct management except protection can be undertaken for this species during the migration and wintering periods. Individuals should be fully protected, and disturbed as little as possible. Perching trees adjacent to favored hunting areas such as trees adjacent to beaches, marshes, open water, streams, deep valleys, and large meadows or grasslands should be preserved. All restrictions and limitations on use of pesticides should be observed. A variety of habitat types in healthy condition should be maintained to assure adequate food supplies. If successful propagation techniques are developed, re-establishment should be attempted in the historic nesting range within the George Washington, Jefferson, Pisgah, Nantahala, Cherokee, and Chattahoochee National Forests.

GREATER PRAIRIE CHICKEN
Tympanuchus cupido pinnatus (Brewster)

ATTWATER'S PRAIRIE CHICKEN
Tympanuchus cupido attwateri (Bendire)

I. General Distribution and Status

Originally the Greater Prairie Chicken occurred from the southern portions of the prairie Provinces of Canada eastward through Michigan and into Ohio, westward into eastern Colorado, and south to northern Texas. Attwater's Prairie Chicken occurred in the Gulf coastal prairies from southwestern Louisiana southward to the Nueces River in Texas. Both subspecies were considered to be common in their ranges.

The present range and population of the Greater Prairie Chicken are much reduced from the original. In 1969, the states in the eastern tall-grass prairie portion of the range reported the following populations:

Indiana - 10	Wisconsin - 1,000
Michigan - 200	Minnesota - 5,000
Illinois - 300	Missouri - 10,000

Iowa, Ohio, Kentucky and Arkansas had no birds at all. States in the great plains portion of the range reported as follows:

Oklahoma - 130,000	South Dakota - 80,000
Kansas - 750,000	North Dakota - 1,800
Nebraska - 100,000	Colorado - 7,600

Only two of the reporting States (Missouri and Oklahoma) indicated that their populations were increasing while four (Indiana, Wisconsin, Kansas, and Nebraska) reported static populations.

Attwater's Prairie Chicken disappeared from Louisiana prior to 1920 and now is largely gone from southeastern Texas north of the Trinity River. A 1937 survey indicated a total population of approximately 8,700 birds which declined to about 1,335 in 1963 and slightly over 1,000 in 1967. The figure for 1971 given in the 1973 Edition of Threatened Wildlife of the United States, USDI, is about 2,200. The same publication gives an estimated population of 16,500 Greater Prairie Chickens in the eastern prairies of Illinois,

Missouri, Wisconsin, and Minnesota and 796,400 to 1,069,400 in the great plains of South Dakota, Nebraska, Kansas and Oklahoma. Attwater's Prairie Chicken is included in the list of endangered species.

II. Life History and Habitat Requirements

1. General

Prairie Chickens, in common with other grouse, are apparently subject to cyclic population fluctuations. In addition, weather conditions during nesting season are so important that they may determine the number of young birds in the fall population. Diseases and parasites, over hunting, and habitat loss also have effects upon population levels. In any event, whatever causes and combinations of causes have been involved, the decline in Greater and Attwater's Prairie Chickens has been severe and rather rapid. In Indiana, for example, the 1912 population was at least 100,000 birds yet in 29 years only about 1,000 remained. Missouri has had a closed season since 1906, yet the original populations of hundreds of thousands numbered less than 15,000 in the early 1940's and about 10,000 in 1969.

2. Food

Prairie Chickens, like other grouse, use a wide variety of foods. Animal matter makes up about 15 to 30 percent of the diet, vegetable matter 70 to 85 percent. The former consists of grasshoppers, beetles, ants, wasps, crickets, and miscellaneous insects. Many different plant foods are taken, including seeds, fruit, grain, leaves, flowers, and buds of such species as ragweeds, goldenrod, spurge, blue-eyed grass, clover, bindweed, greenbriar, acorns, dogwood, buckwheat, blackberry, blueberry, rose, smartweed, various grasses, and grain including oats, corn, wheat and sorghum. There is considerable seasonal variation in the diet, with the plant component being greatest in winter and early spring (as much as 97 to 99 percent).

3. Nesting

Prairie Chicken nests are built on the ground in a slight natural depression or in an excavation made by the bird. This nest hollow is seven or eight inches in diameter and two or three inches deep and lined with dead grass. It is usually placed in dense, tall grass or weeds which effectively conceal the nest, eggs, and incubating bird.

The average clutch is 11 or 12 eggs, but there may be as few as six or seven and as many as 17. The eggs are olive-buff to grayish olive spotted with sepia. The laying period averages two days per egg but the actual laying is irregular, several eggs being laid on consecutive days followed by several days on which none are laid. Incubation is performed only by the female, and requires about 23 or 24 days. The female likewise cares for the young. The eggs of each nest hatch in a short period of time, and the young leave the nest as soon as their down is dry, a matter of a few hours. Sometimes, if hatching takes place late in the afternoon they may remain in the nest overnight.

Prairie Chickens have a very elaborate and spectacular courtship performance. This involves traditional "booming grounds" where the males go through their displays during the spring months and where breeding occurs. An average of 10 to 12 males uses each "booming ground" but the number may be as small as two or as great as 40. The dominant males claim the center portions of the ground as their territories, and most of the breeding is done by these males. Booming begins in late February or early March and extends through May. April is the peak month for breeding.

4. Limiting Factors

In the 1800's Prairie Chickens were one of the principal species which were marketed commercially and market hunters sold thousands of barrels year round. This sort of harvest must have had considerable effect upon populations, but after commercial hunting ceased habitat change was probably the factor which caused continued decline.

Greater Prairie Chickens originally inhabited the tall grass prairies of the mid-west and the mixed grass prairies of the great plains while Attwater's Prairie Chicken occurred in the coastal prairies of southwest Louisiana and northeast Texas. When farming first began in these areas the relatively minor habitat changes probably benefited Prairie Chickens by adding to the food supply. Indeed, some range extension into the great plains occurred as a result of such habitat change. Today, the primary limiting factor seems to be lack of permanent grass of sufficient quality and quantity. This has come about as a result of conversion of grass to tilled crops, removal of grass by grazing and haying, conversion of native grasses to cultivated varieties, and loss of open grasslands to trees and shrubs. In

some situations lack of winter food may limit populations, and in places the grasslands may be unbroken over too extensive an area for best populations. There is general agreement that at least one-third of the non-forested habitat should be in permanent, good quality grass. In some areas populations seem to be holding on with 25 to 30 percent permanent grass.

5. Management

Management of Greater and Attwater's Prairie Chickens has been a major concern for the past 20 years. Much research has been undertaken, refuges and management areas acquired by both public and private agencies, and intensive management operations undertaken on limited acreages. These involve renovation or creation of tall grass areas for roosting, cover and nesting; short grass on the booming grounds; production of supplemental food; winter feeding; trapping and transplanting; in some cases, limited predator control; and protection against direct losses. Conditions existing in each locality where management is undertaken will determine which measures or combination of measures should be employed.

III. Relationship to National Forests

In 1967 Attwater's Prairie Chicken was found in the following Texas counties:

Chambers	Aransas
Jefferson	Calhoun
Liberty	DeWitt
Brazoria	Goliad
Fort Bend	Refugio
Jackson	Victoria
Matagorda	Galveston
Wharton	Harris
Austin	Colorado

The range in these counties is discontinuous, but even so all the counties lie south and southwest of the Texas National Forests and Grasslands. The Sam Houston has some limited areas of blackland prairie but these are probably too small to provide suitable habitat. The other Texas National Forests do not have suitable Prairie Chicken habitat. For these reasons, there appears to be little direct relationship between Attwater's Prairie Chicken and any National Forests.

A national survey in 1969 indicated no Greater Prairie Chickens in Texas and most of those in Oklahoma located in the northeast portion of the state. It breeds in Osage County and elsewhere in the northeast part of the state, and is found fairly commonly in the Bartlesville area and north of Stillwater. Thus, it seems that there is no direct relationship of the Greater Prairie Chicken with either the Oklahoma or Texas National Forests. It is possible that the Grasslands might be utilized but a habitat management program and a transplanting program would be required.

SANDHILL CRANE

Grus canadensis pratensis (Meyer)Grus c. tabida (Peters)Grus c. pulla (Aldrich)I. General Distribution and Status

The sandhill crane was originally distributed in suitable habitat across southern Canada from British Columbia through Manitoba and the north Central States, south to Florida, Mexico, and Cuba, and west to California. Its breeding range is now discontinuous, it occurs only as a migrant in some places, and its winter range is rather restricted.

In the eastern part of the country three subspecies are recognized. Grus canadensis pratensis is the resident bird in Florida and south Georgia. Grus c. tabida which breed in Michigan, Wisconsin and probably southeastern Manitoba winters in north Florida and south Georgia. During the winter months, therefore, the populations of such areas as Okefenokee Swamp, Georgia, and Paynes Prairie, Florida, consist of both the resident and the migrant subspecies.

The resident sandhill crane of south Mississippi has recently been described as a separate subspecies, Grus c. pulla, by Dr. John Aldrich, USFWS. The Cuban bird is designated as Grus c. nesiotus.

Both the Florida sandhill crane (G. c. pratensis) and the Mississippi sandhill crane (G. c. pulla) are included in 1973 Edition of Threatened Wildlife of the United States, USDI. Neither is included in the list of "Endangered Animals", which are those thought to be threatened with extinction. This 1973 edition differs from earlier editions in that it substitutes the term "threatened" for "rare" or "endangered", and lists in an appendix those animals considered to be possibly facing extinction.

Population estimates for Grus c. tabida indicate a total of about 6,000 birds, of which about one-third are in the eastern States. Williams and Phillips (1972) estimated that in some years the winter migrants on Paynes Prairie and nearby habitats numbered from 600 to 1,800 birds. This strongly suggests that most of the eastern population of this subspecies winters in north Florida and south Georgia. The wintering population in Okefenokee Swamp averages approximately 2,000 birds, while the resident population is about 500. Estimated annual production is about 100.

Cranes which winter in north Florida and south Georgia apparently migrate along a nearly straight line from Paynes Prairie and Okefenokee to Michigan and Wisconsin. Birds color-marked and banded at Paynes Prairie were seen or recovered in north central Georgia, east central Tennessee and Kentucky, and northwest Indiana as well as in Michigan, Wisconsin and Manitoba. Atlanta lies on this route and flocks of cranes are seen most years passing high over the city.

Total population of the Florida sandhill crane is estimated to be between 2,000 and 3,000 birds. The Mississippi sandhill crane population, on the other hand, probably does not exceed 40 birds. The range of the Florida sandhill covers extreme southeast Georgia, north Florida west to the Aucilla River, and the Florida peninsula. Most of the birds occur from about the latitude of Ocala south to the Glades although there is a small population in Everglades National Park.

The range of the Mississippi sandhill crane probably extended across the coastal flatwoods and prairies of Louisiana into west Florida at one time. The present remnant population is confined to an area in Jackson County, Mississippi, extending west from the Pascagoula River to about the county line and north from the coast to about 10 miles above Ocean Springs. A small population in southwest Liberty County, Florida, could belong to either the Mississippi or Florida race.

II. Life History and Habitat Requirements

1. General

In the Southeast, at least, the sandhill crane has rather strict habitat requirements. Except while in migration flights, it is almost always found in open low flatwoods, wet prairies, sloughs, and open grasslands. Usually such areas are dotted with pickerel weed and maiden cane ponds. These birds do not use areas of heavy brush or trees.

The sandhill crane is strong and capable in flight, a fast runner, has excellent eyesight and hearing, and a loud, striking call. It migrates at rather high altitudes, and even when not migrating will often circle high in the air for considerable periods of time. It was formerly considered a game species.

2. Food

Most of the sandhill crane's food is vegetable, consisting of roots, tubers, bulbs, seed and fruit of various aquatic

and wet soil plants, grain and berries. It will readily take chufas, grain, and potatoes from planted fields. Millet is probably also used. Animal food is quite varied, although not taken in the quantities that vegetable foods are. Grasshoppers, worms, crickets, frogs, snakes, lizards, tadpoles, mice, and small fish are utilized.

3. Nesting

Most nests are situated in ponds, sloughs, or marshy swales. Others are placed at the edges of swamps. The nest site seems always to be in water early in the season, but as spring progresses conditions become dryer and by late May there may be no water around the nest at all.

The nest itself is a large flattened pile of vegetation such as pickerel weed, sagittaria, maiden cane, other grasses, sedges, and small shrubs. It measures three to four feet across, and generally extends six to eight inches above the water. Vegetation around the nest is torn up and used in construction or trampled down. Some nests will be rebuilt and used for the second and third years. There is a tendency to use the same general nest areas year after year. Several old or inactive nests are frequently found near any active nest, but active nests are usually at least one quarter mile apart. In a few cases they are as close together as 500 feet.

Two eggs are usually laid, although almost a third of the clutches may be only one egg. The eggs are buff, gray, or greenish-gray spotted and blotched with brown. Incubation requires 30 or 31 days. Hatching success indicated by the Mississippi population is about 65%. Predator losses were very low there as well as in other nesting areas.

4. Limiting Factors

The sandhill crane is a species of rather strict habitat requirements. It does not adapt readily to new and different habitat conditions, and in general does not tolerate much human disturbance. Consequently, it seems most likely that the primary limiting factors have to do with habitat conditions and expanding human populations.

There are some losses to shooting since the sandhill crane is desirable for the table. Much of its former range is no longer used because of high human populations

and the associated land use changes. Drainage programs result in changes in vegetative cover which the cranes cannot tolerate. When wet savannas and low, wet flatwoods or sloughs are drained, even slightly, they readily develop a more brushy vegetation which cranes do not use. With planting of pines and a high degree of fire protection, such areas become unusable even more rapidly. Construction of highways, access roads, fire breaks, intensive pasture improvement, agricultural development and its associated drainage, and even housing developments all contribute to the general problem of habitat loss. Almost certainly habitat loss and deterioration is the primary limiting factor on sandhill cranes.

5. Management

Since the limiting factors on sandhill cranes seem to be adverse habitat changes and the pressures of man, management programs must be directed first toward these. Both Federal and State laws protect these birds, but constant and effective law enforcement and public education are necessary.

Maintenance of suitable habitat on private lands is very difficult since the individual landowner has the right, and is easily capable, of effecting the land use changes which convert suitable to unusable habitat. Such changes might seem to be relatively minor, but will still have significant effect in terms of crane habitat and consequently upon populations. For example, on an 18,600 acre study unit in Mississippi there were 10,750 acres of low, wet savanna - good crane habitat. Within a few years, 7,540 acres of this were ditched and planted to slash pine. Within another five to eight years it will be useless as crane habitat.

It is likely, therefore, that the future of sandhill cranes in the Southeast is dependent upon the provisions made for this species on public lands. Existing habitat can be preserved, and in many instances destroyed habitat can be restored by plugging drainage ditches, installing low level retaining dams, taking out pine plantations, and doing controlled burning. Fortunately a considerable amount of important crane habitat is already in public ownership. Most of Okefenokee is a national wildlife refuge, and it is likely that a refuge will be established in the Mississippi habitat. Paynes Prairie is in State ownership. The Everglades population is located within the National Park. Two other national wildlife refuges and four national forests

are potentially important.

Techniques for rearing sandhill cranes in captivity have been developed successfully. Patuxent Wildlife Research Center now has about 40 Florida cranes and nine Mississippi cranes. As these flocks build up, stock can be produced to release in suitable habitat.

III. Relationship to National Forests

Observations of record during the past six years show large numbers of sandhill cranes in central and west Texas; for example, 23,000 near Stanton, 400 on the Welder Refuge, 25,300 on Muleshoe National Wildlife Refuge, 900 at Lake Thomas, and 2,000 at La Sal Vieja, all in December 1966. The following year the Stanton flock was up to 36,500 and in 1968 the Muleshoe flock was estimated at 60,000 during the first week in November. These birds are separate from the eastern populations, however, and involve at least two other subspecies.

Birds which winter in Texas coastal areas doubtless include the tabida subspecies, but not a part of the eastern populations. Observations of such flocks include 360 at Corpus Cristi, 1,000 at Laguna Atascosa, and 3,500 on Arkansas National Wildlife Refuge in December 1968. Peak counts on this refuge sometimes reach 6,300. Thousands of these birds are also seen in western Oklahoma, but very few in the east end of the State.

It is very rare in Arkansas; four seen at Holla Bend National Wildlife Refuge in February 1967 being the second record in over 30 years. Small numbers occur in west coastal Louisiana. In Mississippi there seems to be only the resident population of Jackson County.

A small flock winters in Baldwin County, Alabama, but otherwise it is a rare transient. The species is fairly regularly seen in migration in east and central Tennessee.

Aside from the Okefenokee Swamp, Georgia records for the sandhill crane indicate it to be a migrant. There are a few records for North and South Carolina, where it is an occasional wanderer. In Florida there are, of course, many records, mainly from the central and southern portions.

These data indicate that the Ocala, Osceola, Apalachicola, and DeSoto National Forests may be of significance to the sandhill crane. The DeSoto adjoins the range of the Mississippi population and those portions of the Forest which

have suitable habitat could be managed to provide valuable additional territory for these birds.

The Osceola is reasonably close to Okefenokee Swamp and to localities in north Florida used by sandhill cranes. At present time use of the forest is slight or occasional at best, but areas of suitable habitat should be retained. The situation is somewhat similar on the Ocala. This Forest lacks the large expanses of open, low flatwoods which are attractive to cranes but does have considerable acreage of sloughs and grassy ponds which could be utilized. Management for cranes will require leaving such areas in their natural condition. Available low flatwoods should be burned to keep them open. The Ocala is located between the major crane areas north and south of it, so it is in a strategic position. Lack of sufficient acreage of suitable habitat is the major obstacle to utilization.

Of these four National Forests, the Apalachicola seems to offer the greatest opportunity for crane management. It is within the historic breeding range, has adequate acreage of habitat which is suitable and susceptible to improvement through management, and apparently has a very small remnant flock near Sumatra. This combination of factors plus the probable future availability of captive-reared stock warrant giving serious thought to a program to re-establish sandhill cranes on the Apalachicola National Forest.

LIMPKIN
Aramus guarauna pictus (Meyer)

I. General Distribution and Status

In the United States the Limpkin normally occurs only in Florida and southeast Georgia. There are a few records for the species from South Carolina but apparently it has not been observed in other neighboring states. In Georgia it is generally confined to Okefenokee Swamp while in Florida it seems to occur in suitable habitat east and south of the Apalachicola River. Limpkins also occur in Central America and some of the West Indies (Cuba, Isle of Pines, and Jamaica), but those birds are usually thought to be a separate subspecies.

In suitable situations in Florida limpkins are comparatively common but overall must be considered rather scarce. They are probably more abundant today in Florida than in the 1920's, however. From the 1880's through the 1920's limpkins were commonly shot for food. Large numbers were taken year round, and populations were greatly reduced. When this practice was controlled through increased law enforcement and better public attitude, the species increased in suitable habitat.

II. Life History and Habitat Requirements

1. General

Limpkins have many of the attributes and habits of rails but are also similar to herons and ibis insofar as perching in trees is concerned. Thus, limpkins use both marsh and swamp habitats. They seem to be limited to fresh water situations.

The call of the limpkin is very characteristic, being a loud, mournful wail repeated over and over. In fact, this is mentioned by William Bartram in the accounts of his travels when he wrote "There is inhabiting the low shores and swamps of this river and the lake area of Florida, as well as Georgia, a very curious bird, called by an Indian name (Ephouskyca) which signifies in our language the crying bird".

Although limpkins utilize both swamp and marsh fresh-water habitats, not all such areas are equally suitable. Apple Snails (Pomacea paludosa) are the limpkins' principal food. These animals require waters of fairly high alkalinity, abundant submerged vegetation, and

enough well distributed emergent vegetation to supply sites for attachment of eggs. Thus, good habitat for limpkins must be open enough so that sufficient sunlight reaches the water to promote growth of submerged aquatics, the water must be hard enough to meet the snails' requirements, there must be emergent vegetation on which the snail eggs can be laid, and water levels must be such that the snail eggs are not drowned before hatching. In addition, marshes with large expanses of heavy unbroken vegetation are not used by limpkins nearly so much as those which have a good interspersed of open areas and water courses.

2. Food

Limpkins may not feed exclusively on apple snails, but the apple snail is the principal food. Other species of snails may sometimes be taken, and perhaps some worms and aquatic insects. The birds have favorite feeding places, such as an open spot on a bank or an old log, where they bring the snails to eat them. Numbers of empty shells can be found around such spots.

3. Nesting

Several types of nests are built by limpkins. In marsh situations the nests are placed in clumps of sawgrass, flags, or similar vegetation anywhere from just above to three feet above the water level, and are built of marsh vegetation to form a bulky platform. In swamps or brushy situations nests are placed on limbs or in bushes up to 18 feet above the ground or water and usually in tangles of vines and other vegetation. Such nests are rather flat and are built of sticks, vines, leaves, and Spanish moss.

Four to eight eggs, usually five or six, are laid. They are smooth, slightly glossy, and colored various shades of buff. There are longitudinal blotches of dull brown, mainly on the large end. Nesting usually occurs from February through April, but sometimes begins as early as December and extends through August. Incubation time is not known. The young leave the nest the same day they hatch.

4. Limiting Factors

During the years that limpkins were killed so heavily for food and shot indiscriminately, these losses

probably were the primary limiting factor. The bird was not wary and made an easy target. Accounts of large numbers being killed are not unusual. At present, this factor is well controlled and it is likely that direct losses are minimal.

Thus, it is the extent of suitable habitat that now seems to be the primary limiting factor. Habitat losses have occurred because of conversion of marshes to agriculture, as in the upper St. Johns valley, the Kissimmee Valley, and the upper Everglades. In other cases swamps have been altered through drainage or conversion to open water impoundments. Pesticide-laden run-off from agricultural lands likely also is detrimental. Because the limpkin does have rather strict requirements, such changes can have large scale adverse effects.

5. Management

Continued protection is necessary to prevent direct losses since the limpkin is quite vulnerable in this regard. Beyond this, any management program must provide suitable habitat and adequate food. A basic requirement is water of sufficient hardness to produce good populations of apple snails. If such water is available, manipulation of water regimes can increase snail populations. This usually requires a dike system to hold water and pumping or other means of water supply. Overly dense swamp areas can be opened up, and marsh vegetation conditions can be improved mechanically or by burning and flooding.

III. Relationship to National Forests

The three National Forests in Florida are all within the limpkin's range. Of these, the Osceola is least important since it has the least suitable or potentially suitable habitat. Portions of the Apalachicola National Forest are close to important limpkin habitat on the Wakulla and St. Marks Rivers. Reaches of the New River and Sopchoppy Rivers within the Apalachicola National Forest should be studied to determine existing occupied and potential habitat. Management of these areas for limpkins probably would not have a top priority, but they should be managed to retain their potentials.

The Ocala National Forest and some of the areas immediately adjacent to it are very important for limpkins. Among the more important areas are the easterly edge along the St. Johns River and Lake George, Juniper Springs Run, Alexander Springs Run, Salt Springs Run, Lake Kerr, the Oklawaha River between

Roads 40 and 316, the upper reaches of Rodman Pool, and the Oklawaha River between Rodman Pool and the St. Johns River.

All of these localities have at least moderate populations of limpkins though the Salt Springs - Lake Kerr area (not actually National Forest lands) has such heavy human use that bird use is probably limited. The upper half of Rodman Pool has an excellent limpkin population, probably as good for its size as any in Florida. Prime habitat and food conditions were created, quite inadvertently, by the manipulation of water levels and vegetation which resulted from original construction, subsequent operations, and associated legal suits to halt the Cross Florida Barge Canal. This situation should be taken into consideration in future management of Rodman Pool.

Limpkin also occur in other lakes and prairies within the Ocala. Such areas should be maintained in their natural condition for continued use by these birds.

ROADRUNNER
Geococcyx californianus (Liesson)

I. General Distribution and Status

In the past, the Roadrunner was generally considered to be distributed through the Southwestern United States and southward to central Mexico. In the United States this original range extended north to north-central California, Colorado, and southern Kansas; east through central Oklahoma; and south through east-central Texas. Within this range the Roadrunner is fairly common.

In recent years, the Roadrunner has extended its range eastward so that it now occurs through east Texas, approximately the western two-thirds of Arkansas, and approximately the north-west quarter of Louisiana. In these two States it is fairly common but not real abundant. The greater part of this range expansion seems to have taken place in the last 10 to 15 years.

Eastward extension seems to be continuing in Arkansas and in the last three years has been recorded in Poinsett and Cross Counties. In Oklahoma the Roadrunner breeds virtually throughout the State in forested areas and along wood edges. It is commonest in black mesa country.

II. Life History and Habitat Requirements

1. General

If the Roadrunner does not qualify as unique by reason of distribution or abundance it does qualify by reason of appearance and habits. This species seems almost to be a comic character, with short rounded wings, long slim legs, long tail, coarsely streaked plumage, and prominent crest. The Roadrunner is fast and agile enough to depend on its running to escape its enemies and to capture its food.

Through most of its range the Roadrunner occurs in dry, brushy, even desert habitat. In east Texas, Arkansas, and Louisiana it occurs in pine and mixed pine-hardwood habitats and associated roadsides and fields or pasture edges.

2. Food

Roadrunners utilize a wide range of animal foods,

including lizards, snakes, grasshoppers, spiders, small birds and mammals, and many insects. Such items constitute about 90 percent of the diet. Fruits and seeds make up the remainder. The Roadrunner's appetite is remarkable for its size. It is fast and agile afoot to capture its prey, including three or four foot leaps into the air to catch small birds and grasshoppers. The prey is generally killed by striking with the bill, sometimes by beating against a stone, then swallowed whole.

3. Nesting

Roadrunners occasionally nest on the ground, but usually they build in bushes, small trees, or cacti three to 15 feet above the ground. The nest is about a foot in diameter and six to eight inches high, though not deeply cupped. It is made of sticks and lined with grass, leaves, feathers, small roots, and sometimes a snakeskin.

The usual clutch is three to five or six, but sometimes there are as many as 12 eggs in a nest. These situations may be the result of more than one female using the same nest. The eggs are white with a yellowish tint. These are laid at intervals of several days but incubation begins when or soon after, the first egg is laid. Incubation requires about 18 days, and supposedly is only by the female. The eggs hatch at intervals, so that the same nest may contain new nestlings, incubating eggs, and young birds several days old. Eggs are usually laid in April and May but some are laid as late as July.

4. Limiting Factors

In some States bounties have been paid on Roadrunners, presumably because they fed on young quail. In other cases they have been unprotected and hunted for sport. Eggs and young birds are doubtless taken by various predators, and occasionally an adult is taken by a hawk. All of these factors probably have some effect upon population levels but probably none of them constitute a prime limiting factor. Availability of suitable habitat and food is more likely to be the primary factor, but this cannot be stated with certainty.

5. Management

As in any case where limiting factors are poorly defined, management programs will necessarily be rather general.

Roadrunners utilize a variety of habitats but do have some requirements which must be met. Since most of the feeding activity is on the ground, there must be sufficient open or low vegetation areas to allow the birds to capture their prey. And, the habitat must be in good enough condition to provide adequate populations of prey species. In addition to suitable feeding areas, there must be brushy or understory vegetation to provide nest sites.

Protection from harassment and direct losses is likewise required.

III. Relationship to National Forests

Roadrunners are fairly common on all the Texas National Forests and on the Caddo and Cross Timbers National Grasslands. On the Ouachita National Forest in Oklahoma it was considered unique a few years ago but now is common forest-wide. In Arkansas it is fairly common on both the Ozark and Ouachita National Forests. In Louisiana it is a common permanent resident on the Kisatchie National Forest, especially the Caney, Winn, and Kisatchie Divisions.

RED-COCKADED WOODPECKER
Dendrocopos borealis (Vieillot)

I. General Distribution and Status

The Red-cockaded Woodpecker is a species of the Southeastern States. Its range includes eastern Texas and Oklahoma, southern Missouri, the Western Cumberland Plateau in Kentucky, southern Virginia, the Eastern Shore in Maryland, and the other States south and east of these. There are a very few old records from Ohio, New Jersey, and Pennsylvania. The species is nonmigratory.

In the early 1800's Audubon wrote of the Red-cockaded Woodpecker as being abundant. It is likely that since that time its population trend has been generally down because of extensive loss and alteration of habitat. The species is included in the list of endangered birds in the 1973 Edition of Threatened Wildlife of the United States, USDI, Fish and Wildlife Service.

In 1971, Dr. J. A. Jackson estimated the total population at about 3,000 birds and stated that the actual number may be two to three times this. Additional work since that time has revealed more birds, and the estimate given in the 1973 Edition of Threatened Wildlife of the United States is 3,000 to 10,000.

II. Life History and Habitat Requirements

1. General

The Red-cockaded Woodpecker is closely associated with the Southern pines (longleaf, slash, loblolly, and shortleaf), and show a strong preference for open, mature stands. Trees which are used for nest and roost cavities are almost always infected with red heart (Formes pini). This association and preference are so marked that the Red-cockaded Woodpecker is generally considered to require mature diseased pines for its existence. In an east Texas study (Lay and Russell, 1970), the trees in areas being used by this species ranged from 8.8 to 24.6 inches dbh. In age they ranged from 56 to 193 years with mean ages on three study areas of 103, 89, and 72 years. Similar data for cavity trees from north Florida (Baker, 1971) show an age range of 59 to 167 years with an average of 85 years. The dbh range was 10.3 to 32.7 inches and the average 18.7 inches. In South Carolina the age range

was 38 to 135 years with an average of 80 years. The dbh range was 10 to 24 inches with an average of 16.3 inches.

Studies carried out in Alachua, Baker, and Columbia Counties, Florida (Crosby, 1971) showed mean stand densities of 48.67 to 142.61 stems/acre and mean basal areas of 27.78 to 56.00 square feet/acre in utilized habitat. Similar studies in the Tallahassee-Thomasville section of Florida and Georgia (Thompson and Baker, 1971) indicated a mean density of 53.24 pine stems/acre with a range of 6 to 182. The mean basal area was 52.92 square feet/acre and the range 10 to 140. Understory vegetation in preferred habitat is generally less than five feet tall. Birds will certainly use areas where the understory is 10 to 15 feet and even taller, but generally do not feed below the height of this ground cover.

Red-cockaded Woodpeckers usually occur in small groups - one pair to 8 or 10 birds. In some of these clans each bird has its own cavity which is used throughout the year. In other colonies (groups of hole trees) there are fewer cavities than birds in the clan. An individual bird might occupy the same cavity for several years, and a single cavity may be used for at least 20 years. Roost sites other than cavities are usually below the base of a limb, or in some fork or crevice where there is overhead protection.

The home range of a pair is approximately 35 to 50 acres. A clan of 8 birds will utilize a range of about 160 acres. Clans with fewer birds probably require less territory, and densities of one colony to 66 acres and one to 167 acres have been reported. Colonies average about 6 trees and range from 2 to 9. Each tree has from one to 8 or 9 cavities, usually one or two. Such colonies will range from 1/2 to 5 acres in size and average about one and one-half acres. The stand of timber supporting each colony will vary from about 5 to 25 acres. This acreage is related to the site index and age of the timber, with fewer acres required where the trees are older and larger.

2. Food

Red-cockaded Woodpeckers use about 85% animal matter, mainly insects and arthropods, and 15% vegetable matter, mainly fruits and mast. The latter include wax myrtle, magnolia, wild grape, poison ivy, pokeberry, blueberry, wild cherry, and black gum. Ants are a common food item, as are the larvae of wood boring insects. Spiders and centipedes are fed on extensively, and the birds spend

considerable time feeding on lightning-struck and other dying pines when they become heavily infested with insects such as Ips beetles. They will also take suet and water at feeders.

Where cornfields occur within their territory, Red-cockaded Woodpeckers feed heavily upon earworms when the corn is in the tassel and ear stage. During this time, a period of four to six weeks, the adults and recently fledged young may feed almost entirely in the corn fields, taking some other insects in addition to earworms.

3. Nesting

The cavities in any colony may be in varying stages of completion, from just begun "start holes" to nest chambers complete with a vertical tunnel extending above the entrance tunnel. Such nest cavities are also used for roosting. Some roost cavities apparently are never fully completed to become nest cavities.

These cavities are almost always in living, mature pines although there are a very few records of other trees being used. Pines utilized for nest and roost cavities are almost always infected with red heart. The birds chip bark away and drill into the sapwood around each cavity to cause a heavy and continued flow of resin. A glaze of this live resin is characteristic of nest cavities. When the resin ducts eventually dry up, so that fresh resin no longer flows, another cavity will be used for nesting, but old cavities are used for roosting. What purpose this resin serves, and why the birds provide for it, are not really known. It may serve as a defense against snakes and other birds.

Excavation of a roost or nest cavity takes considerable time. Ten or eleven months seems to be the minimum, while others may be under construction for two years or more. About 60% to 70% of cavity openings face toward the west and southwest. This exposure may favor increased resin flows because of solar heat. Cavities may range from about 10 feet to 100 feet above the ground.

Red-cockaded Woodpeckers apparently pair for long periods, perhaps life. The clan may consist of a pair, several other adults, and several young. The non-breeding birds serve as "helpers" and assist in feeding the young.

Clutch size is two to five, three or four is usual.

The eggs are pure white, but often smeared with resin. Incubation requires 12-13 days. Usually one or two young are fledged. Nests with "helpers" fledge more young. This requires 26 to 29 days, but the young are dependent upon the adult for at least some of their food for five months or more. Nesting generally takes place in April and May.

4. Limiting Factors

Early ornithologists considered the Red-cockaded Woodpecker to be a fairly abundant species in its habitat. Observed general declines in population coincided fairly well with cutting of the larger, more mature pine timber. It is this type of forest which best meets the strict requirements of this species for roost and nest sites. Thus, the very nearly complete dependence of the Red-cockaded Woodpecker on living pine trees old and large enough to be infected with red heart is probably the most important limiting factor on this species.

Other things, of course, may also be involved although none are so conspicuous as the nest and roost tree requirement. One important factor may be reduced food supplies because of widespread applications of pesticides. There is circumstantial evidence, based on comparative growth of nestlings with and without "helper" birds, that availability of food can be a critical factor in number of young fledged. If abundance or availability of food is reduced by pesticides, it may constitute a limiting factor.

5. Management

Management for Red-cockaded Woodpeckers must be primarily concerned with providing suitable nest and roost trees, and an acreage of suitable habitat adequate to supply the food needs of the clan. Suitable nest and roost trees are primarily longleaf, loblolly, slash, shortleaf, and, to a lesser extent, pond pines which are approximately 80 years or older. The stands should be open, with average densities of 45 to 55 stems/acre and basal areas of 50 to 60 square feet/acre. Understory vegetation should be low, preferably not over three to five feet in height.

These conditions can be provided in carrying out the management concept of even-aged stands forming an all-aged forest if specific adjustments are made for their accomplishment. Simply leaving the individual cavity trees is not adequate. All the cavity trees forming a colony plus its associated support trees should be retained since the

overall population of Red-cockaded Woodpeckers is low enough to warrant saving all active nest sites. Colonies can be expected to average about one and one-half acres, and their support stands can be expected to range from 5 to 25 acres. Trees in the support stand serve to protect cavity trees, provide for future cavities, and furnish food and cover to the birds. The support stand is essentially a buffer around the colony or individual cavity tree.

The pair or clan requires a home range of about 35 to 160 acres, depending on the number of birds involved. This includes the area described as the support stand. The home range acreage serves as the foraging area, and the birds are dependent upon it to supply their food needs. Trees of younger age classes (probably 30 years and up) will be utilized for feeding. There is evidence to the effect, however, that food is less abundant or less available in trees of these younger age classes. For this reason it is desirable to have as much of the home ranges in 60 to 80 plus age classes as possible. Understory vegetation in the home range should be low since the birds generally do not feed lower than the height of the understory. Maintaining such understory conditions will usually involve a properly designed and executed controlled burning program.

Since it is likely that wide scale use of persistent insecticides has adverse effects upon Red-cockaded Woodpecker populations, such applications should be held to the absolute minimum.

III. Relationship to National Forests

Except for those situated in the Appalachian Mountains, the National Forests of the Southern Region are extremely important to the Red-cockaded Woodpecker. In several States it is likely that a major portion of the State population occurs on National Forest lands. The species occurs in greatest numbers on the Croatan, Francis Marion, Sumter, Osceola, Ocala, Apalachicola, Angelina, Davy Crockett, Sabine, Sam Houston, and Kisatchie National Forests. The Oconee, Bankhead, Talladega, Conecuh, Tuskegee, Homochitto, and Bienville National Forests apparently have smaller populations, but are still very important. Available maps indicating known colony locations are attached.

Aside from National Forests, distribution records for the Red-Cockaded Woodpecker show the following occurrences

(Counties not containing National Forest lands are not repeated in this listing):

North Carolina - Scotland, Wake, Hoke, Moore, Halifax, Wayne, Tyrrell, Orange, Beaufort, Brunswick, New Hanover, and Cortaret Counties.

South Carolina - Carolina Sandhills National Wildlife Refuge and Sandhills State Forest, and Georgetown, Williamsburg, Horry, Charleston, Berkeley, and Aiken Counties.

Georgia - Piedmont and Okefenokee National Wildlife Refuges, and Floyd, Thomas, Pierce, Brantly, Tatnall, Muscogee, Harris, Glynn, and McIntosh Counties.

Florida - Collier, Wakulla, Alachua, Brevard, Osceola, Palm Beach, Volusia, Duval, Lee, Leon, Glades, Highlands, Bay, Walton, and Santa Rosa Counties.

Alabama - St. Clair, Jefferson, Baldwin, and Calhoun Counties.

Mississippi - Noxubee National Wildlife Refuge, and Harrison, Pearl River, Wayne, Scott, Smith, Madison, Hinds, Franklin, Jackson, Lauderdale, Leake, and Jones Counties.

Louisiana - Tangipahoa, Caddo, Bienville, Ouachita, Washington, and St. Tammany Parishes.

Arkansas - Monroe, Ashley, Union, Ouachita, Columbia, Lafayette, Hempstead, Polk, and Clark Counties.

Texas - Cherokee, Newton, Nacogdoches, Harrison, Tyler, Hardin, Liberty and Polk Counties.

Oklahoma - McCurtain and Latimer Counties

Tennessee - Catoosa Wildlife Management Area, Pickett State Park, and Carter, Campbell, Cumberland, Monroe, McMinn, Morgan, Sevier, and Knox Counties.

Virginia - Virginia Beach and Sussex Counties.

IVORY-BILLED WOODPECKER
Campephilus principalis (Linnaeus)

I. General Distribution and Status

The Ivory-billed Woodpecker is the largest woodpecker in the United States, and perhaps for this reason and for its striking color pattern seems to have long been of unusual interest to man. The bill and plumage were highly valued by various Indian tribes as charms and wearing apparel, and constituted important trade items between northern and southern tribes. Early white settlers and backwoodsmen used the bills and head plumage as decoration for shot pouches, and considered the meat highly desirable as food.

The original range of this species included the coastal states from North Carolina to east Texas and extended up the Mississippi Valley to southern Ohio and Illinois. The account of this species by A. A. Allen in Life Histories of North American Woodpeckers (Bent, 1939) states that the species is almost extinct, remaining in only a few isolated localities in Louisiana, Florida, and South Carolina. Ten years later this general status still prevailed, although Texas was added to the list of possible locations. (South Carolina Bird Life, Sprunt and Chamberlain, 1949). The 1970 Edition of this work indicates that a few birds were reported from Florida in the late 1950's and states that efforts to substantiate a 1961 report in South Carolina were not successful.

Probably the last detailed field work on the Ivory-billed Woodpecker was that of A. A. Allen and P. P. Kellogg and James T. Tanner during the years 1935-42 in Louisiana. In the past ten years there have been numerous unsubstantiated reports, most of which turned out to be pileated woodpeckers. In addition, a very few reports from Florida and South Carolina seem valid. It was reported from Texas in 1967. The 1973 Edition of Threatened Wildlife of the United States, USDI, states that recent records exist for southeast Texas, southern Louisiana, and central South Carolina, but lists the status as "probably very close to extinction".

II. Life History and Habitat Requirements

1. General

The Ivory-billed Woodpecker is often confused with the Pileated, but it is quite a different bird. At rest, the Ivory-billed shows much white on the lower part of

the wings while the Pileated shows none. In flight this white on the Ivory-billed shows conspicuously on the trailing edge of the wings while the Pileated shows much less. The Ivory-billed's flight is non-undulating whereas the Pileated dips up and down like several other woodpeckers.

Mature bottomland hardwoods and cypress swamps comprised the Ivory-billed Woodpecker's habitat, and it always seems to have occurred in or very close to such areas. The precise factor which only this habitat provided is not clearly understood, however, for the bird was known to feed in both hardwoods and pines as well as on the ground. It is possible that only large acreages of mature forests could supply the quantity of wood boring insect larvae required for food.

2. Food

The Ivory-billed Woodpecker fed heavily upon wood-boring insects, bark beetles, and ants. It also fed on such fruits as magnolia seed, pecans, and poison ivy berries. Some food was obtained by digging into dead trees or the dead limbs of live trees, but much was also obtained by scaling the bark from dead trees.

3. Nesting

Cypress was apparently the tree species most used for nesting, but maples, elms, oaks, and royal palm were also used. The Ivory-billed Woodpecker excavated its own nest, selecting a location 30 to 60 feet above the ground. Often the nest tree, a living cypress, was in standing water. The opening was about 3 1/2 x 6 inches, and the cavity about 20 inches deep by nine inches in diameter. The bark was often shredded from the tree for several feet above and below the entrance hole.

Nesting apparently took place anytime from early February to late April. The usual clutch was three eggs, although as many as five have been recorded. Reproductive success was low and often only one young was raised.

4. Limiting Factors

It is probable that the primary limiting factor on the Ivory-billed Woodpecker was its apparent dependence upon extensive acreages of mature cypress swamp and bottomland hardwoods. As suitable habitat of these types was reduced the population declined until only isolated segments

remained. Under these circumstances the reproductive success was too low to sustain a population.

In earlier years considerable numbers of Ivory-billed Woodpeckers were taken by both Indians and whites, for the bird was not especially wary. This could have been a contributing factor, but the final cause of the birds' decline was almost certainly a loss of habitat.

5. Management

Since lack of sufficient tracts of suitable habitat is apparently the factor responsible for the decline of the Ivory-billed Woodpecker, any possible management would have to provide these conditions. How practical this would be is very doubtful. However, any areas in which the birds might be found should surely be preserved, and complete protection given to the birds.

It is possible that a subspecies, C. p. bairdii, still exists in Cuba although in very limited numbers. While there is presently no reason to think that Cuba would be interested, it may be possible to secure a few of these birds to attempt restocking or rearing in captivity.

III. Relationship to National Forests

If future findings are made of the Ivory-billed Woodpecker, they might well be in the Francis Marion or Apalachicola National Forests. Should this happen, the birds should be given complete protection. The inhabited range should be carefully determined, and this range, which may encompass several thousand acres, plus an adequate buffer should be managed to maintain its mature timber.

FLORIDA JAY
Aphelocoma coerulescens coerulescens (Bosc)

I. General Distribution and Status

The Florida Jay, or Scrub Jay, is confined to the State of Florida, and to only the peninsular part of the State at that. Eight or nine other subspecies occur in the southwestern States.

Not only is the Florida Jay confined to the Florida peninsula, it is found in one distinct habitat type in that geographic area. That habitat is the scrub, and this bird is so closely confined to it that the more common name is Scrub Jay. The scrub habitat type is characterized by a whitish sandy soil and vegetation dominated by various combinations of sand pine, several shrubby oaks, palmetto, and rosemary. The oaks and saw palmetto form dense, low thickets. This habitat type occurs in a rather narrow strip along the east coast from St. Johns County to Miami, through the central part of the State primarily from the vicinity of Ocala to southern Highlands County and portions of Glades County along Fisheating Creek. On the west coast it occurs in limited areas from northern Collier County about to the mouth of the Suwannee River. This "west coast" area does, in fact, extend 20 or 30 miles inland but the scrub is not continuous.

Little information is presently available on population levels, though some study is underway and should provide additional data. It is recognized that fluctuations occur over periods of several years but the extent and cause are not known. Thus, the species may be found in relative abundance some years in some localities, but be uncommon in the same areas in other years. Always it is confined to this one habitat type, and in many parts of the State considerable acreages of this type have been converted to other use. Overall, the Scrub Jay must be considered now as a rather uncommon bird.

II. Life History and Habitat Requirements

1. General

The Florida Jay has such strict habitat requirements that it seems to never occur very far outside the scrub. Although this affinity is well recognized, the reasons for it are not known.

Florida Jays are generally much less boisterous and

aggressive than Blue Jays, and often seem to have no fear of man. They will often take food from the hand, and frequently will allow themselves to be touched and even moved about when incubating. Florida Jays often perch on telephone wires, but most of their time is spent in the low scrub and on the ground.

2. Food

The Scrub Jay is rather omnivorous, taking about 60 percent plant food. The animal matter consists of a wide range of insects, beetles, caterpillars, spiders, ants, flies, centipedes, ticks, snails, and lizards. Plant foods include acorns, grass seed, milkweed, huckleberry, and blueberry.

3. Nesting

Nests are usually placed 4 to 12 feet above the ground in scrub oaks or sand pines. They are built primarily of oak twigs lined with fine rootlets and other plant fibers. Frequently two to 6 or 8 pairs will nest fairly close together forming a sort of loose colony.

Nesting usually takes place between March and May.

Both male and female take part in nest building, incubating and caring for the young. There are usually 3 to 5 eggs, bluish green marked with blotches of reddish brown. Incubation requires 15 to 17 days, and the young remain in the nest for another 18 to 20 days. During the nesting period both adults and young seem to be very little disturbed by human activities.

4. Limiting Factors

Availability and extent of the single habitat type utilized by Florida Jays is likely the primary limiting factor on the species. In some areas the scrub habitat is cleared for house sites and subdivisions because it often occupies the higher elevations and affords good drainage. Such changes in habitat are almost certainly the determining factor in regard to population levels.

5. Management

The first requirement in management for Florida Jays is scrub habitat of sufficient extent and distribution. If this is available, it should be maintained in its natural condition.

It is entirely possible that the carrying capacity of this habitat type can be increased through supplemental feeding. Such a program would be simple and relatively inexpensive in view of the Scrub Jay's non-migratory and omnivorous habits. Any of the commercially available "quail feeders", or some other simple food dispensing device, filled with a small pelleted feed for dogs, cats, or fish should be satisfactory.

Protection should be given to prevent direct losses.

III. Relationship to National Forests

During the past 6 to 8 years, Florida Jays have been regularly recorded from the following representative locations:

South Brevard County	Sanford
Stuart	Mt. Dora
Cocoa	Orlando
Ft. Pierce	Lake Placid
Ft. Lauderdale	Sarasota
Vero Beach	Tampa
West Palm Beach	Punta Gorda
Merritt Island	Captiva
Ocala National Forest	
Fisheating Creek Wildlife Management Area	
Avon-Park Wildlife Management Area	

Thus, it is obvious that Ocala is the only National Forest which has any relationship to the Florida Jay. This is an important relationship, however, since the Ocala supports a good population, and is one of the few areas which definitely can retain the required scrub habitat. Scrub Jays should be able to survive in the Ocala despite declines in other areas.

Two subspecies of Scrub Jay occur in Oklahoma and Texas, as follows:

Aphelocoma coerulescens texanus (Ridgway) - Resident in west-central Texas in the southern Concho River drainage and the Edwards Plateau from Tom Green and Concho Counties south to Kerr, Edwards and Crockett Counties.

Aphelocoma coerulescens woodhouseii (Baird) - Resident from north-central on central Utah, southern Wyoming, western and southern Colorado and western Oklahoma south to northeast Arizona, southern New Mexico, northern Chihuahua, and western Texas. Casual in Nebraska, southwest Kansas, and the Texas Panhandle.

RAVEN
Corvus corax principalis (Ridgway)

I. General Distribution and Status

Ravens are widely distributed over all the continents of the Northern Hemisphere, and have been separated into several subspecies. In North America, Corvus c. principalis ranges in the west from northwestern Alaska southward through western United States and Mexico. In the east it ranges from northern Greenland southward to central Minnesota, Michigan, New Jersey and in the higher Alleghenies to Georgia.

In the northern part of their range, Ravens are common and may be quite closely associated with man and his dwellings. They are recognized as valuable scavengers about the native villages of Alaska, northern Canada, and Greenland, are generally not molested, and are accustomed to relatively close contact with humans. They do not seem to lose their wildness, however, and do not allow too close an approach.

Although Brewster in 1885 considered them common in North Carolina everywhere above 3,000 feet, in the Eastern States today, from Pennsylvania southward, Ravens are not widely distributed and are generally uncommon. Hooper (1973) tentatively estimated that there may be 3,000 breeding pairs in the Southern Appalachians, about one-third being in Virginia.

II. Life History and Habitat Requirements

1. General

As might be expected in a bird so widely distributed, Ravens have a wide variety of habits and actions. They are among the most crafty, bold, resourceful, and adaptable birds. They are wary, seem to quickly learn by experience, and are powerful and hardy. In flight they are strong and masterful.

Ravens likewise utilize a variety of habitats. In the far North they range over treeless tundras, or utilize forested river banks, or frequent coastal beaches and rocky shores. They often live in the vicinity of sea bird colonies where they prey upon eggs and young birds. From Pennsylvania southward

Ravens are mainly mountain birds. In the Southern Appalachians they usually live above 3,000 feet but often move to lower elevations to feed. They seem to prefer cliffs and escarpments. In some respects their habits are similar to the crow's and they are usually seen in groups of two or three to six or eight birds.

2. Food

Ravens are practically omnivorous, and will eat apparently any kind of animal matter that they can catch, kill, or find. Whether it is fresh, slightly decayed, or in the late carrion stage seems to make no difference. It also eagerly feeds upon fruit such as blackberries. When animal food is abundant, Ravens will sometimes bury portions in the ground to be used later. When garbage dumps are available, Ravens usually make heavy use of them. At the same time, these birds are powerful enough predators to catch and kill rabbits and even young deer.

3. Nesting

Ravens use two distinct types of nest sites - cliffs and trees. In the Appalachian cliff sites outnumber tree sites about eight to one. In other places, such as northern New England and parts of Canada, the proportion is more even.

Tree nests are usually placed in the highest available tree that offers good cover at the top and a substantial double or triple crotch to support the nest. Such nests may be over four feet across with a cavity a foot in diameter and six inches deep, placed 45 feet or more above the ground. The nest is built of dead branches and sticks, with an inner lining of twigs, bark shavings, and very frequently deer hair. If deer hair is not available, tufts of hair from cattle, dogs, or horses may be used.

Cliff nests are generally placed in well shaded, protected locations. Nests may be placed under an overhang of the cliff, or in a spot sheltered by bushes or small trees. Height of the cliff is also important, for most cliffs which are used have drops of at least 50 feet. If the size of the ledge or crevice permits, cliff nests will be three to four feet in diameter. Ravens apparently do not nest nearer to each other

than about 3 1/2 miles. They have, however, been known to utilize the same cliffs as peregrine falcons.

Four or five eggs is the usual number, but as many as eight have been recorded. They are colored various shades of dull bluish-green marked with dull, dark brown. Incubation requires about 21 days and is done mainly by the female. The young stay in the nest four to five weeks, but are still cared for by the parents for several more weeks after leaving the nest.

4. Limiting Factors

Although in many ways the Raven is an aggressive and adaptable bird, it does seem to require relatively large undisturbed areas for nesting. It is this factor which may account for its decline in the Eastern States during the years that the Appalachian Mountains were heavily logged, road and rail networks were being expanded, and human populations in these areas were high. There apparently has been some increase in numbers as the forest became more mature, rural human populations declined, and possibly, deer populations increased. Temporary recreational use of mountain areas has likewise contributed to the Raven's food supply.

Ravens have few natural enemies, and it is not likely that direct losses to man are now significant.

5. Management

Habitat protection is apparently the most important item in any management program for Ravens. Preservation of suitable nest sites and protection from harassment during nesting season are essential. This means that both the potential sites and those known to be used should be located so they can be adequately considered in all use and development activities.

Food availability seems to have considerable effect upon Raven movement other than in nesting season. Protection against shooting and other direct losses must be afforded during such times.

III. Relationship to National Forests

In Georgia the Raven occurs usually only in the extreme northeast corner of the State. Prior to 1958 it was recorded as breeding on Brasstown Bald and occurring on Blood Mountain

and Rabun Bald. It is now frequently seen on Rabun Bald, Brasstown Bald, and other high balds but is not known to breed. There is one record for Cumberland Island.

There are several records for coastal South Carolina (Charleston, Berkeley, and Beaufort Counties), and in the early 1900's Ravens were fairly common and nested in Oconee, Pickens, and Greenville Counties. At present it occurs in Oconee County within the Sumter National Forest (see attached map).

Occurrences in Tennessee include Newfound Gap, Roan Mountain, other portions of the Great Smokey Mountains National Park, and Tellico.

North Carolina locations include Grandfather Mountain, Blowing Rock, Pilot Rock and Hanging Rock, plus three or four coastal records.

In Virginia Ravens are distributed throughout the Jefferson National Forest with concentrations around Mt. Rogers National Recreation Area, Peters Mountain, and Mountain Lake where there are two concentrations of about 100 birds each. It is also fairly common in the George Washington National Forest and along the Blue Ridge Parkway. Other recent observations were at Goshen, Willis Mountain in Buckingham County, College Lake at Lynchburg, Big Flat Mountain, Blacksburg, Lexington, Warren, Rockingham County, Peaks of Otter, Waynesboro, and Roanoke.

Over 160 birds were reported from a dozen localities in Oklahoma and Texas, on Christmas Counts made from 1966-71. Over 100 of these came from the Chisos Mountains of Texas. In Oklahoma in recent years Ravens are becoming common in Black Mesa County.

From these records it is clear that State Wildlife Management Areas, Great Smokey Mountain National Park, Blue Ridge Parkway and the George Washington, Jefferson, Pisgah, Nantahala, Cherokee and Chattahoochee National Forests constitute most of the present Raven range in the Southeast. Of these, the National Forests furnish the greatest amount of occupied and potential habitat. The future of the Raven in the Southern Appalachians is in large part dependent upon the manner in which it is managed on the National Forests.

REPORT ON RAVEN STATUS IN WESTERN
NORTH CAROLINA

Discussion with W. D. Zeedyk of the Forest Service in Asheville brought out the following details on ravens. Maps are also provided for specific locations.

The Joyce Kilmer Memorial Forest in the Nantahala National Forest, Graham County contains one area of known raven sightings. Cold Spring Knob in the north central portion of Joyce Kilmer is a raven use area with altitude of about 5,000 feet. It is the only known area in this portion of the Nantahala.

Farther east in Cherokee, Clay and Graham Counties, the Nantahala has two suspected areas of raven use. In the vicinity of Hayesville, Snowbird Top in the Snowbird Mountains is a suspected area, as is the Fires Creek area directly south of Andrews approximately five miles by air.

Approximately two miles due east of Lake Nantahala is Rocky Bald. This area, also in the Nantahala National Forest, is a known area of raven utilization and a known nesting location.

Although there are no verified sightings, the Cowee mountains, particularly around Peaks Mountain and Leatherman Bald, is suspected raven habitat. This location is in Swain and Macon Counties and is also a portion of the Nantahala National Forest.

Just north of the North Carolina-Georgia state line, the Appalachian Trail crosses Big Kitchens Knob. Ravens are currently utilizing this knob with the latest report coming this fall by Bill Zeedyke. Again the altitude is in the neighborhood of 5,000 plus feet. This segment of Clay County is yet another corner of the Nantahala.

Satula Mountain and the Horse Cove Creek area of Macon County is a known raven area.

Nearby Devils Courthouse and Whitesides Mountain in Jackson County are well known raven habitats. There is an October 19, 1973 record for Whitesides Mountain.

The last location in the Nantahala National Forest is Terrapin Mountain in Jackson County. This mountain is known to be a rookery as recently as this summer (73).

The Pisgah National Forest contains much valuable raven habitat. The first such location is just south of the Shining Rock Wilderness off the Blue Ridge Parkway. Sam Knob, Tenneset Mountain,

Black Balsam Knob and Devils Courthouse are all heavy use areas. Devils Courthouse and Black Balsam Knob are known nesting sites and the latter is also a roost of some 80 plus birds.

The Frying Pan Mountain and Gap has yielded a report of up to eight raven sightings in a single day. To the southeast at Arden, ravens have concentrated at the city dump primarily in the winter. This is within easy range of all of the above mentioned areas and all locations are found in Haywood and Transylvania Counties.

Another area of suspect, but to date lacking verification, is the Tamassee Ridge. This ridge of seemingly suitable raven habitat forms a boundary of Jackson and Transylvania Counties.

Several sightings have come from the region around the North Carolina-Tennessee border. Another area on the Appalachian Trail, Max Patch Mountain, again in the 5,000 foot range, is an important area for ravens. To the south in the same general locale, Cherry Creek and Little Fall Branch have had several observations. Farther to the Southwest Sutton Top and Waterville Lake near Longarm Mountain are also notable points for raven sightings.

There is an important area off Forest Service property that is of some note. The Sandymush Mountain region in Madison and Buncombe Counties has been recorded as a nesting area with a wide surrounding range. Since it would require a lengthy explanation to pinpoint this, I have made a special note on the map.

The Bald Mountains are another range forming the border of North Carolina and Tennessee. Here Big and Little Firescald Balds are known raven habitat. This is part of Madison County.

Mitchell and Yancey counties contain six places of interest to this report. Roan Mountain is a known raven hang out. It is the second highest peak in North Carolina and is greater than six thousand feet in elevation.

Elkwallow, south of Roan Mountain, was described by Mr. Zeedyke as ideal raven habitat. He mentioned the area as being composed of old pasture areas, presently abandoned, surrounded by fairly high forested land. As an interesting side note, Elkwallow is in an area of somewhat unusual place names. Pigeon roost is nearby, perhaps the harks back to the days of another species that was not lucky enough to be included in an endangered species study.

The Unicoi Mountain range southwest of Elkwallow has four raven areas. Beauty Spot, Beauty Spot Gap, Bowling Green Creek are known for past sightings. Cane Bottom on the Nolichucky River is a suspected nesting location. There is an exposed rock cliffs situation available and would appear to be suitable for breeding.

The area north of Black Mountain contains six raven areas. The Coxcomb Mountain - Brush Fence Ridge - Pinnacle Gap zone is considered to be generally high potential raven habitat. Mount Mitchell is of course prime territory with as many as eleven reported in a day.

East of Mt. Mitchell ravens have concentrated at Hazelnut Gap where four have recently been reported. Busick is also a noted observation site and Bear Drive Creek is a known nest site.

Linville Gorge Wilderness Area is a truly rugged piece of real estate. Here at Pinnacle and Shortoff Mountain ravens nest on cliffs overlooking the Linville river. The Shortoff Mountain cliff is 500 feet high and again points up a marked preference for cliff situations overlooking on very near flowing water of considerable size.

Another area of private ownership but heavy use is Grandfather and Grandmother Mountains. A nest was recorded from Grandfather Mountain last year (72). This too is extremely high and adjacent to the Linville River.

The majority of the known raven areas in North Carolina are on Forest Service property. Ravens are regarded by many as a common bird in this corner of their range. It is interesting to note here however that Bill Zeedyke is of the opinion that the raven is not as common as most would believe. He logically believes that given the range of the bird, its sheer physical size, and vocal habits, the raven appears to be more numerous than he actually is. A good analogy was drawn by Mr. Zeedyke between the raven and a turkey vulture. The vulture is often a victim of the same principle of overestimate by size and range.

If the overall population in terms of numbers had to be estimated, Zeedyke would agree with me that 400 to 500 birds would be a relatively sound guess.

BACHMAN'S WARBLER
Vermivora bachmanii (Audubon)

I. General Distribution and Status

In general terms, the range of Bachman's Warbler is the Southeastern United States, the Bahamas, Isle of Pines, and Cuba. It has been recorded in northeastern Arkansas, southeastern Missouri, southern Indiana, central Kentucky, Alabama, Mississippi, Louisiana, Georgia, Florida, North and South Carolina, and Virginia.

Bachman's Warbler was discovered by Dr. John Bachman near Charleston, South Carolina in 1833 and named for him by Audubon. Two specimens were taken, and several others seen. Apparently the species was not found again in the United States until 1886 when one was collected at Lake Pontchartrain in Louisiana. During the next two years 37 specimens were collected there. Fairly large numbers were collected and reported in Florida during the 1880's and 1890's.

Populations have apparently declined steadily through this century and Bachman's Warbler has been extremely rare at least since 1950. Populations likely have always been quite localized, but have reached the point where probably no more than 35 birds have been recorded since 1950. These were made mostly in South Carolina but also in Alabama, Florida, Virginia, and Louisiana. Today it is perhaps the rarest song bird in the United States, and is on the list of endangered species in the 1973 Edition of Threatened Wildlife of the United States, USDI.

II. Life History and Habitat Requirements

1. General

Bachman's Warbler is primarily a swamp species. The bird was first discovered in heavily timbered swamp with dense undergrowth including cane and palmetto, and most of the nesting has been found in similar habitat. During migration it also occurs in heavy swamps along the Suwannee and other rivers in north Florida but such habitat is not found at Key West where it has been found in numbers during migration. Also, one bird which was closely observed near Charleston, South Carolina in 1958 was utilizing about 1.3 acres of an open stand of loblolly and longleaf pines which had a dense understory of oaks,

myrtle, and sassafras averaging about seven feet in height. Thus, although the primary habitat seems to be dense, mature hardwood swamps with heavy undergrowth and considerable standing water, Bachman's Warbler does utilize other types, including pine and mixed pine, which have dense understories.

2. Food

Little specific information is available on food habits. Bachman's Warbler is known to feed on caterpillars, and probably on various insects and ants. Some of its feeding actions suggest that it ingests liquids, either dew or plant juices. These animal and plant foods are utilized by other species of the same genus.

3. Nesting

Although Bachman's Warbler was discovered in 1833, its nest and eggs were not found until 1897 when a nest was located near the St. Francis River in Arkansas. The nesting area was described as over two acres of blackberry vines among a tangle of fallen tree tops in pools of water. Nests in South Carolina were located in heavily timbered swamps subject to flooding and having a thick understory of cane, palmetto, blackberry, and various vines and shrubs. They are placed about two feet above ground, in brush or cane, and built of dried weed and grass stalks, cane leaves, and skeletonized tree leaves. The lining is fine grasses and usually a black plant fibre which may be a lichen or Spanish moss. Nests are 3 1/2 to 6 inches high and 3 to 6 inches wide with a cavity 1 1/2 to 2 inches deep and about 2 inches across.

The usual clutch is three to four eggs, but there are sometimes five. No information is available on incubation nor, and more importantly, on reproductive success. The species is an early nester. Migrants reach Florida in late February and South Carolina in March. Egg laying mainly occurs from late March through mid-April.

4. Limiting Factors

There is much speculation but no real knowledge as to what factors limit the Bachman's Warbler populations. The fact that it was not recorded between 1833 and 1886, then found in reasonable abundance through the early 1900's only to again become very rare since

1950 makes it obvious that there is no simple explanation for its fluctuations.

The preferred habitat seems to be dense hardwood swamp with heavy understory and it is true that much of this type has been altered, especially in the Mississippi Valley. This could be a contributing factor. In other cases, swamps which had birds in the 1940's seem unchanged in the 1970's but have had no Bachman's Warblers recorded in 20 years. At the same time, the nature of the preferred habitat is such that it is rather transitory, and tracts of this habitat may shift about through the years within any large swamp. Because of this, plus the bird's secretiveness, relatively small home range, and the inaccessability of the habitat, Bachman's Warblers may be undected for years in large swamp areas.

Alteration of wintering habitat could be a factor, but persons familiar with recent conditions in Cuba and Isle of Pines state that such changes have been minimal.

Direct losses by man have occurred in the past, but there has been little of that in the past 50 years and it is unlikely that such losses constituted a prime limiting factor. At present there is no entirely satisfactory explanation for the decline of Bachman's Warbler.

5. Management

Because of the present lack of knowledge, about the only management program for Bachman's Warbler which can be undertaken is protection of any known birds and preservation of habitat. Even this is made more difficult than usual because so few birds are seen that there is no sure way of knowing what areas should be preserved.

III. Relationship to National Forests

It is likely that Bachman's Warbler was discovered in what is now the Francis Marion National Forest, and the majority of later work on the species in South Carolina was done there. Most South Carolina observations in the past thirty years have likewise been associated with this Forest. Probably the section of greatest importance is I'on Swamp, and this area should certainly be preserved. This type habitat has many other values so that its preservation serves other interests besides the Bachman's Warbler.

Other National Forests which may be of importance to Bachman's

Warblers are the St. Francis, Delta, Ocala, and Apalachicola although there are no recent occurrence records.

In all cases, full protection should be given to any birds which occur, and immediate determination should be made as to extent and nature of the habitat being utilized so that it can be protected.

IPSWICH SPARROW
Passerculus princeps (Maynard)

I. General Distribution and Status

The Ipswich Sparrow has extremely restricted breeding and wintering ranges. It nests on Sable Island, about 100 miles out in the Atlantic Ocean east-southeast from Halifax, Nova Scotia. About 20% of the population remains on Sable Island year round. The rest of the population winters along the Atlantic Coast, mainly from New Jersey through Virginia, but also as far south as southeast Georgia. Despite the length of the winter range, it is actually quite limited for it consists only of the ocean beach dune zone plus the beach above high tide and the grassy areas just behind the dunes.

The 1973 Edition of Threatened Wildlife of the United States, USDI, includes the Ipswich Sparrow and estimates the breeding population in 1967 to have been 4,000 birds. The 1968 estimate of the A.O.U. was only 1,000 birds, however.

The Ipswich Sparrow was described as a species on the basis of a specimen taken by C. J. Maynard at Ipswich, Massachusetts, in 1868. The extent of its wintering range was not defined for many years, and its breeding range was not defined until 1884. At that time, eggs collected on Sable Island in 1862 and uniformly larger than those of the Savannah Sparrow were believed by Robert Ridgway to belong to the Ipswich. This belief was confirmed shortly thereafter by collection of birds on Sable Island. The residents there had known it all along, calling it "gray bird".

There has been uncertainty for many years as to whether the Ipswich should be considered a geographical race of the Savannah Sparrow. The 1957 A.O.U. Check-List retained it as a species but the "Thirty-second Supplement to the A.O.U. Check-List" (Auk, Vol. 90(2), April 1973) considers Passerculus princeps a subspecies of Passerculus sandwichensis, so that it becomes P. sandwichensis princeps. The English species name of the enlarged P. sandwichensis remains Savannah Sparrow. Ipswich Sparrow remains available for princeps. This change was accepted by the Committee on Classification and Nomenclature.

II. Life History and Habitat Requirements

1. General

The Ipswich Sparrow nests only on Sable Island, which is about 24.5 miles long with a maximum width of one mile.

Maximum elevation is about 80 feet, but the soil is almost all sand. There are no trees, but the interior of the island has dense growths of bayberry, blueberry, and crowberry along with grassy areas and some ponds. The dunes have good growths of beach grass (Ammophila sp.).

The wintering range includes the ocean beach dunes, where sea oats and associated grasses are the characteristic vegetation, along with the front beach above high tide and the grassy areas just behind the dunes. The bird is therefore quite strict in its habitat requirements.

2. Food

The summer diet of the Ipswich Sparrow consists of about 75% animal matter, 15% plant matter, and the remainder sand or gravel. In winter animal food declines to about 8-10% while vegetable food increases to about 60-80%. Animal matter includes beetles, flies, weevils, caterpillars, and spiders. Vegetable food includes several species of grass seed and the fruits of bayberry, blueberry and dock.

3. Nesting

Ipswich Sparrows nest on the ground, usually in a location protected by low bushes or by clumps of grass. The nest measures about 2 1/2 inches inside diameter, 5 inches outside diameter (although the wall thickness may vary from 1/2 to 2 inches), and depth about 2 inches. There is an inner lining of fine grasses and an outer shell of coarse materials.

The clutch is usually four to five eggs. These are bluish or grayish white with a great variety and extent of brown and reddish-brown markings. Although not known with certainty, the incubation period is probably about 12 days and the fledging period about 14 days. Late nesting has been observed but it is not known whether these are second broods or renesting.

4. Limiting Factors

The Ipswich Sparrow is apparently most limited by changes occurring in the very restricted habitat which it occupies.

Sable Island is subject to severe erosion, so that its nesting range is by no means secure. Much, if not most, of its winter range has been altered by the great increase in man's utilization of the ocean beaches and dunes in the past 20 years. As a consequence of these changes in both the breeding and wintering habitat, this species is in difficulty.

Adverse weather may also limit the population of Ipswich Sparrows. Abnormal amounts of ice or snow in the northern portions of the winter range apparently kill quite a few birds in some years.

5. Management

The greatest need in preserving the Ipswich Sparrow is maintenance of its unique habitat. Presumably there are few direct losses during the nesting season although it is possible that cats, dogs, and rats prey upon eggs and young. If this is true, these predators should be controlled. It is probably not practical to undertake any measures which could prevent the continued erosion of Sable Island.

Wintering habitat does not require any alteration or improvement, but only needs to remain in its natural condition. Establishment and operation of such areas as the Cape Cod, Asateague, and Cape Hatteras National Seashores; Chincoteague, Back Bay, Pea Island, Cape Romain, and Black-beard Island National Wildlife Refuges; and Sapelo Island Wildlife Management Area of the Georgia Department of Natural Resources will help to assure the continued availability of wintering habitat. Even so, it is likely that the more important parts of the wintering range are those which are most subject to degradation because of heavy human use.

III. Relationship to National Forests

Because of its limited distribution the Ipswich Sparrow does not have a direct relationship with any National Forest in the Southeast. Mr. A. T. Wayne was much interested in the species, but in 46 years of active field work in Coastal South Carolina found it on the mainland only three times. It could occur, of course, on the Croatan or Francis Marion but would be only accidental.

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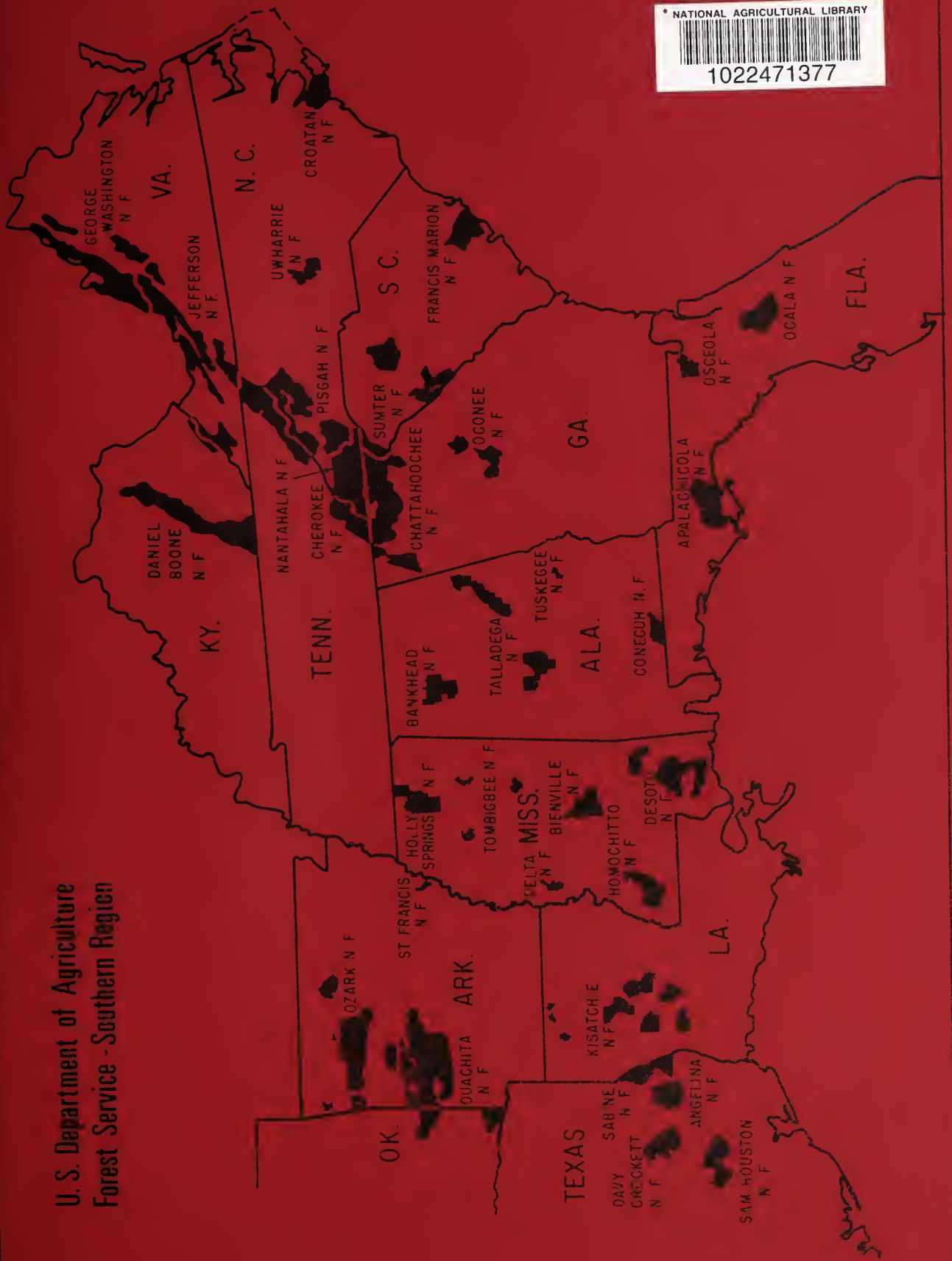
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